

Are We Developing Self-Regulated Learners In Grade 8 Mathematics Classrooms: A Case Study Conducted At A High School In Kwa-Zulu Natal.

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DECLARATION

I hereby declare that: **Are we developing self-regulated learners in grade 8**

mathematics classrooms: A case study conducted at a high school in Kwa-Zulu

Natal is my own work and all the sources I have used or quoted have been indicated and acknowledged by means of references.

D. Mundenhwa

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ABSTRACT

The aim of the study was to investigate whether self-regulated learners are developed in Grade 8 mathematics classrooms. The research was conducted at Khula High School, which is situated at Magabheni, near Umkomaas in Kwa-Zulu Natal. Qualitative research approach was adopted for the study. Data was collected through the observation of one Grade 8 mathematics class. A total of eight mathematics lessons were observed and a semi-structured interview was conducted with the mathematics teacher. The findings of the study reveal that the educator did try to develop self-regulated learners through the use of teaching strategies that match the requirements of Outcomes Based Education.

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CHAPTER ONE: INTRODUCTION

According to Prawat (1992), traditionally, teachers are seen as tellers of truth who inculcate knowledge in learners. Learners play a relatively passive role. They are accumulators of material who listen, read and perform prescribed exercises. According to this author there has been transformation regarding this situation. Prawat (1992), further argues that being provided with a new set of theoretical or conceptual “lenses” can be empowering for teachers. Pape (2002) explains that the way we think about the domain of mathematics and what constitutes competence within the domain has changed internationally. Traditionally, mathematics has been viewed as a body of facts and procedures to be mastered.

According to Pape (2002) new goals have been set that include an emphasis on conceptual understanding, communicating reasoning and mathematical understanding, and learning through problem solving and inquiry, teachers’ knowledgeable of the content and their learners’ knowledge of the domain, are called to support all learners’ efforts to understand mathematics, by engaging learners in rich mathematical experiences. In such environments, learners are challenged to reason mathematically, to explain and justify their mathematical reasoning, and to construct their mathematical knowledge through exploration and problem solving.

Pape (2002) further stated that these statements provide just a glimpse of the reform vision of mathematics teaching and learning. Mathematics education teachers and

researchers are now trying to understand the impact of classroom contexts on developing mathematical reasoning. For example, according to this author, a significant number of researchers are investigating the intricacies of classroom norms and discourse patterns that build classroom communities conducive to meaningful development of mathematical understanding. The implementation of reform in mathematics classrooms makes possible the development of self-regulated learners and at the same time, necessitates developing self-regulated learners (SRL) (Pape, 2002). Self-regulated learners have clear goals for their performance. They monitor and adjust their behavior, motivation, affect, and cognition according to their goal which becomes the standard. Self-regulated learners are self regulated, not controlled or manipulated by outsiders. True self-regulation is not manipulated by the teacher, although the learning of self-regulation may begin with a program initiated by the teacher (Stipek & Pintrick, 2000).

According to Grolnick, Kuruwski & Guland (1999), one of the major goals of education is to facilitate the development of students who will be lifelong learners: those who engage in the school enterprise, see its value and go beyond the minimum requirement. These authors believe that one of the major goals of schooling is to create a self-regulated learner. They further argue that self-regulated behaviours are those that have an internal locus of causality. They are engaged in learning choicefully, out of interest and have personal goals or desired outcomes. According to Quicke (1994) education should involve the development of “whole” persons as self-directed agents and autonomous learners.

According to Department of Education (2001), South Africa's 1994 democratic elections marked a turning – point for education and curriculum development in South Africa.

The new Department of Education developed its vision of a different future for South Africa's children through the National Qualifications Framework (NQF) and the first National Curriculum Statement, Curriculum 2005 (C2005).

The Department of Education (2001) suggested that by the end of the General Education and Training (GET) band, the National Curriculum aims to produce a lifelong learner, who is:

- Confident and independent
- Literate, numerate and multi – skilled
- Compassionate, with respect for the environment, and an ability to participate in society as a critical and active citizen.

Considering what has been stated in the introduction, I have decided to focus my attention on the learning processes of Grade 8 learners at Khula High School. The subject that is the focus of the research is mathematics. The reason for selecting Grade 8 learners is linked to the new pass requirement suggested by the Department of Education (2002). According to this requirement, a learner must pass mathematics if he/she is to be promoted to the next grade level. According to the researcher, learners experience problems in mastering mathematics. Most learners do not pass mathematics and they

have internalized the belief that it is a very difficult subject, which cannot be mastered easily.

This study sought to examine the effectiveness of instructional techniques and strategies that are used in Grade 8 Mathematics classes in developing self – regulated learners. The instructional techniques and strategies that are now used in Grade 8 classes are supposed to match the requirements of Outcomes Based Education.

According to the Department of Education (2001), Outcomes Based Education:

- Is developmental, it encompasses both what learners learn and are able to do at the end of the learning process.
- Emphasises high expectations of what all learners can achieve.
- Is a learner – centered educational process.
- Through its outcomes at the end of the learning process shapes the learning process itself – the process of learning is thus considered as important as what is learnt.
- Is an activity – based approach to education designed to promote problem – solving and critical thinking.

The above outcomes would suggest that creating learners who are self-regulated would be one of the curriculum goals in mathematics.

The critical question explored in the study was: Are we developing self-regulated learners in Grade 8 Mathematics classes?

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK FOR THE STUDY

2.1 Introduction

A number of international studies have presented various perspectives about self-regulated learners. Different theories have been used in trying to explain and understand how self-regulated learning can be promoted among the learners. The theories that inform the present study are presented in this chapter.

2.2 Examining the Notion of the Self-Regulated Learner

Paris & Paris (2001) mentioned that over the past 30 years, definitions of self-regulated learning have become increasingly encompassing. Early descriptions characterized self-regulated learners as metacognitively aware, planful and strategic (Brown, 1987 cited in Butler 2002). According to Butler (2002) through the 1980's and the 1990's, conceptions of self-regulated learning evolved which comprised interactions between learners' knowledge (e.g. metacognition, domain specific, epistemological), metacognitive skill (e.g. planning, monitoring), motivation (e.g. application of a cognitive strategy). An emphasis has been on how self-regulated learning is a function of the knowledge and skill that learners construct over time.

At the same time, evolving definitions of self-regulated learning focus on how enactment of self-regulated approaches to learning depends on individual acting in

social contexts (Paris & Paris, 2001). This perspective emphasizes that self-regulated learning emerges from more than just an individual's knowledge and skill. Rather, self-regulation also involves a social aspect that includes interactions with peers and teachers who shape students' task engagement by "co-regulating" (Light & Littleton 1999; Muthukrishna & Borkowski 1996; Patrick & Middleton 2002; Palincsar in press; Schunk and Zimmerman in Ryan 2002). By definition, self-regulated learning is now thought to occur when learners are motivated to reflectively and strategically engage in learning activities within environments that foster self-regulation.

According to Butler (2002) the complex definitions of self-regulated learning that have evolved over the past 30 years can be linked to shifts in methodology. As Patrick and Middleton (2002) explain, socio-cultural perspectives that emphasize how self-regulated learning is shaped socially have led to qualitative methodologies that investigate self-regulated learning in context. As a result, emerging definitions of self-regulated learning have assisted researchers and teachers to develop integrative theories about learning that are broadly encompassing. Butler (2002) mentioned that definitions of self-regulated learning that include both social and individual processes also raise important conceptual questions. For example, how is self-regulated learning both an individual and a social process? What are individual and socio-cultural influences of students' development of self-regulated learning? Increased clarity on these topics may be useful in building theory, constructing methodologies for studying self-regulated learning and advancing practice (Butler, 2002).

2.2.1 Characteristics of self – regulated learners

According to Stipek & Pintrich (2000) the following are the characteristics of self-regulated learners:

Self-starters, who demonstrate great persistence when learning, especially in the face of failure.

More likely to believe they can master “this” task.

Confident, strategic and resourceful in overcoming obstacles.

Understand themselves and their abilities (strengths and weaknesses)

Self – test in situations: reading and preparing for the test.

Self – motivated.

Self- aware. They know how well they do before test is graded.

Take on challenging tasks resulting in meaningful new learning.

They have a plan for learning, that is,

- Clear goals for how well they will do and what to do.
- Clear strategies to achieve their goals (time management)
- Rehearse and memorize information (and a plan for how).
- Organize and transform information.
- Use deeper level processing skills such as integrating information and monitoring comprehension.
- Keep record of progress and self-monitor and self-reinforce.
- They are in “control” of their motivation and their affect.

2.3 Theoretical Framework

The theory that inform the present study is presented on this section.

Socio-cultural approaches of learning and teaching are informing this study. Packer & Goicoechea (2000) mentioned that the roots of socio-cultural theory can be traced back from Vygotsky to Marx and Hegel. One of the themes that appear in the work of these theorists is that the person is constructed. The human person is not a natural entity but a social and historical product. The human person is *made* not born. Looking at this statement, it makes one believe that it is possible to produce self-regulated learners.

Vygotsky believed that every function in the child's cultural development appears twice: first on the social level, and later on the individual level, first between people (interpsychological), and then inside the child (intrapsychological) (Newman & Holzman, 1993). This applies equally to all voluntary attention, to logical memory, and to the formation of concepts. All the higher mental functions originate as actual relations between people. Berk (2000) mentioned that, according to Vygotsky, children are active seekers of knowledge, but he did not view them as solitary agents. In his theory, rich social and cultural contexts profoundly affect the way children's cognitive world is structured.

Berk (2000) further indicated that Vygotsky believed that all higher cognitive processes develop out of social interaction, through joint activities with more mature members of

society. Children come to master activities and think in ways that have meaning in their culture. A special concept, the zone of proximal (or potential) development, explains how this happens. It refers to a range of tasks that the child cannot yet handle alone but can be accomplished with the help of adults and more skilled peers. This is described as a process of scaffolding. Donald, Lazarus & Lotwana (2002) argue that, basically, scaffolding involves mediating key and/or strategic element of a particular topic of understanding – appropriated, of course, to a student’s own level of development. These mediations challenge the student at whatever level he/she is, to develop his/her understanding to a more powerful level. In the process of scaffolding, the mediator provides help and suggestions but gradually withdraws as the student reaches a level of constructing his own internalized understanding. Rogoff (1990) cited in Halonen & Santrock (1996) stated that social interaction and culture play important roles in children’s cognitive development. She argued that a child’s cognitive development should involve an “apprenticeship” with companions who will strengthen the child’s written and oral language skills, maths skills, and memory strategies to preserve information over time.

Berk (2000) indicated that Vygotsky’s theory offers new version of teaching and learning – one that emphasises the importance of social context collaboration. According to Berk (2000) Vygotskian classroom goes beyond independent discovery, it promotes assisted discovery. Teachers guide children’s learning, carefully tailoring their interventions to each child’s zone of proximal development. Assisted discovery is also fostered by peer

collaboration. Classmates with varying abilities work in groups, teaching and helping one another.

Donald, Lazarus & Lolwana (2002) explain that Piaget made it clear that from birth, people actively and continuously organize and re-organize information and experiences so that they can adapt to their world in progressively more effective ways. Vygotsky's socio-constructivist theory stresses the critical importance of the "social" in meaning construction.

Although Vygotsky stressed the role of the mediator in the developmental construction of knowledge, his concept of the zone of proximal development (ZPD) incorporates the notion of active agency on the part of the learner. More significantly perhaps, Vygotsky help us to understand that knowledge in general is not passively received. It is actively constructed through the process of social interaction (Vygotsky as quoted by Donald, Lazarus & Lolwana, 2002).

Patrick & Middleton (2002) point to the fact that the cognitive skill of self-regulated learning is socially constructed. Meyer & Turner (2002) stated that self-regulation is achieved through social interactions and has multiple outcomes, academic and non-academic, which are understood within context. Yowell & Smyle cited in Meyer & Turner (2002) argue that a focus on the individual inaccurately implied that regulation is only an intrapsychological process, and ignores the role of others and the social context in self-regulation. These authors define self-regulation as the intentional and playful

pursuit of goals in a manner that is flexible, and that promotes individual growth and social change.

McCaslin & Good cited in Meyer & Turner (2002) indicated that the development and support of self-regulation occurs through reciprocal interaction among individuals and the social context elements. Such contextualized frameworks also infer reciprocity between teacher and student that evolve through co-regulation. These authors believe that viewing classroom learning as a negotiated process between an individual and others, and autonomy as a relationship, rather than an individual attribute, suggests that self-regulation may be better understood as a social process.

2.4 Links Between Theory and Mathematics Teaching and Learning

This study aims to investigate whether self-regulated learners are developed in a Grade 8 mathematics classes. Therefore, this section attempts to indicate how the theory presented above can be related to what takes place in the mathematics classrooms.

2.4.1 Self-regulation and the learning environment

According to Cobb, Wood & Yeckel (1993) cited in Pape (2002) social constructivists espouse the perspective that mathematics is best learned within a social environment.

Problem-solving behaviors or ways of thinking that set the domain of mathematics apart from others are best developed within a particular classroom environment. As teachers

maintain an environment in which the development of understanding is constantly monitored through reflection, students are more likely to learn to take responsibility for reflecting on their work and make the adjustments necessary when solving problems. Fennema, Sowder & Carpenter (1999) cited in Pape (2002) state that understanding should be an essential norm of the mathematics classroom.

Pape (2002) further mentions that classrooms in which students expect to provide an explanation and a justification for their responses facilitate the development of mathematical thinking and SRL. When thinking is articulated regularly, patterns of thinking develop that are iterative. Thinking cannot be articulated unless students reflect on the problem and the strategies they use to solve it. Articulation in turn, increases reflection, which leads to understanding. Teachers are responsible for developing such environments. They must devote class time to “talking about talking mathematics” (Cobb, Wood & Yackel, 1993 cited in Pape 2002). In other, teachers need to emphasize what constitutes an explanation or mathematical argument...how one reasons within the domain...and must help learners understand their role as critical listeners in classroom discussions. Critical here, means that students must learn from critique, and validate mathematical reasoning. Through such critical examination, students learn to monitor their own thinking in the service of reasoning about and understanding important mathematical concepts. Perry, Van De Kamp, Mercer & Mordby (2002) stated that a hallmark of high self-regulated learning environment is that they challenge learners without threatening their self-efficacy. According to Butler (2002) learners’ self-

regulation can be enhanced or inhibited by the circumstances in which they find themselves.

2.4.2 Problem solving and self-regulation

Pape (2002) believes that learners should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort, and should then be encouraged to reflect on their thinking. Mathematics instruction should, for example, enable the students to apply and adopt a variety of appropriate strategies to solve problems, and to monitor and reflect on the process of mathematical thinking. These behaviors are very similar to those discussed within SRL literature, including monitoring progress toward solutions, adjusting behavior depending on observation of progress, reading and listening carefully to ensure understanding, planning frequently, considering alternative strategies and reflecting on one's progress among others. The more students can take responsibility for their own learning, the more likely they are to attribute success to their own efforts. If students believe that their efforts will make a difference in what and how much they learn, then they are more likely to expend higher levels of efforts in their studies (Pape, 2002).

Killen (2000) stated that one important historical change in the way we look at teaching is that we now emphasize that a teacher's main role is to facilitate learning rather than to be a source of all knowledge. This means that teachers have to help learners construct their own knowledge, rather than simply telling them things that they are expected to

memorize. According to Cobb, Perlwitz & Gregg (1998) the teacher must be able to capitalize on children's interpretations, solutions and explanations when guiding the development of classroom mathematical practices. Only then can the teacher fulfill his or her obligations to the school, and to wider society without steering or funneling children to predetermined responses that the teacher has in mind all along. Mathematics, as it is realized in the classroom, is then a genuine process of argumentation rather than a sterile social guessing game.

2.4.3 Peers as models for self-regulated behavior

Ryan (2000) mentioned that experimental studies provide evidence that peers are potentially powerful models for the socialization of motivation, engagement and achievement. According to this author, studies have found that children change their criteria for standards for self-reward on experimental tasks after observing the self-reward behaviour of a peer. In addition, children's preference for challenge on a variety of tasks is influenced by exposure to a peer model's preference for a challenge (Sagotsky Lepper, quoted by Ryan 2000).

Schunk & Zimmerman (1996) cited in Ryan (2000) provided evidence that self-efficacy beliefs are influenced by peer models. For example, children who experienced difficulties with mathematics were exposed to a mastery or coping model who was working on mathematics problems. Peer mastery models solved mathematics problems correctly and verbalized statements reflecting high self-efficacy and low task difficulty. Peer coping

models initially demonstrated difficulty with the problems and verbalized negative statements but ultimately verbalized high efficacy statements and solved the problems correctly. For children who experienced problems in mathematics, coping models enhanced self-efficacy. Their own self-efficacy was bolstered – perhaps thinking “If that student can have trouble and then succeed, then even if I have trouble, I can succeed” (Ryan 2000:107).

According to Pape (2002) classroom dialogue enable students to be exposed to strategies used by their more sophisticated peers, and to ways of thinking that may be different from their own. This dialogue produces within them a stance toward learning that is consonant with SRL theory from an educational psychology perspective. It facilitates the necessary forethought, self-monitoring and self-reflection that are crucial to self-regulation. Most importantly, when both learners and teachers are expected to provide verification for their thinking, it provides the models that are imperative for beginning to develop self-regulation. All learners may begin to imitate these ways of thinking as they progress toward self-regulation. Zimmerman (1989) is of the idea that the impact of modeling on self-regulation is given particular emphasis in social cognitive formulations. According to this author, the modeling of effective self-regulated strategies can improve the self-efficacy for even deficient learners.

2.4.4 The role of the teacher in the development of self-regulated learners

This section highlights the role that teachers can play in developing self-regulated learners in their classrooms.

Borkowski & Muthukrishna (1995) stated that the teacher in a discovery environment is a critical mediator in a transactionally based instructional process. According to these authors, an effective teacher maximizes task involvement by inducing learners to collaborate with each other in order to be able to gain understanding. In a study conducted by Borkowski & Muthukrishna, teacher's behaviors included verbalizations such as, What do other think of what Peter just said? Do you agree – disagree with what Peter says? Can anyone explain what they thought Sally was thinking when she solved the problem? How can we check to see if your answer makes sense? Has anyone solved the problem in a different way? The verbalizations indicated that teacher mediation often requires process-oriented answers, and apparently assist in the development of self-regulatory capabilities, such as monitoring and reflecting (Borkowski & Muthukrishna, 1995).

In a study conducted by Glasersfeld (1998), what was discovered was that if we repeatedly tell the children that their solutions to problems are wrong, we should not be surprised that their enthusiasm for tasks involving numbers dries up. If, instead, we ask children, "How did you go about getting this answer? What was discovered was that in many cases, learners are capable of seeing for themselves that something did go wrong.

At that point, children become aware that it is they who are capable of constructing solutions to problems, and that they themselves can decide whether something works or does not. This is the beginning of self-regulation, of a feeling of autonomy, and the start of a potentially active learning. Greeno, Pearson & Schoenfeld (1999) mentioned that in any domain, an essential ingredient of competent performance is knowing how well one seems to be doing at any given moment, and acting on that knowledge.

2.4.5 Learners' will and skill

According to Stipek & Pintrick (2000) self-regulated learning is a fusion of skill and will. Schmalz (1989) cited in Killen (2000) stressed that it is very unlikely that learners will solve problems successfully without willingness and perseverance. No one has ever solved a problem without wanting to do so, and this desire must be strong enough to keep one working when the problem proves to be difficult. According to this author, we need to emphasize to learners that they can become better problem solvers by wanting to solve problems and by working hard. Concomitant with this notion of perseverance is the ability to ponder the problem even over a long period of time. Perseverance can be encouraged by helping learners to understand that not all problems are easy to solve but that insight into a problem often comes at unexpected times.

A good example from mathematics is the problem of developing a proof of Fermat's last theory (that there is no whole number solution to the equation $a^n + b^n = c^n$ for n greater than 2). This problem took more than 300 years to solve! This particular example can also be

used to illustrate the point that it is often difficult to get experts to agree about whether or not a problem has been solved (Killen, 2000).

2.5 Empirical Studies Focusing on Self-Regulated Learning

I have been able to locate a limited number of studies that examine the issue of self-regulated learning within classroom contexts. These studies explored teaching and learning in the subject areas of language and Mathematics. In this section, I will try to highlight issues that emerge which are related to my study.

The first study presented was conducted by Cobb, Perlwitz and Gregg (1998). These researchers conducted a classroom-based research and development project in elementary school mathematics. The argument here was that the teacher and learners together create a classroom mathematics tradition or microculture, and this profoundly influences students' mathematical activity and learning. Sample episodes were used to clarify the distinction between the school mathematics tradition in which the teacher acts as the sole mathematical authority, and the inquiry mathematics tradition in which the teacher and learners together constitutes a community of validators.

A series of second and third grade teaching experiments were conducted with seven and eight-year-old learners at both a rural/suburban site and an urban site that serves an almost exclusively African-American learner population. Each of these experiments lasted for the entire school year, and involved intense collaboration with classroom

teachers who were responsible for all instruction. The researcher's goal in these studies was to develop instructional strategies and complete sets of instructional activities that support learners' personal construction of increasingly sophisticated conceptual operations and methods in mathematics. The data gathered consisted of video-recordings of all lessons for the school year, copies of all the children's written work, field notes, and video-recordings of clinical interviews conducted with all learners at the beginning, middle, and end of the school year.

The original intention of the researchers before they began the first experiment was to use detailed cognitive models of children's arithmetic concepts to account for mathematical learning as it occurred in the social setting of the classroom. These models had been developed by analyzing clinical teaching sessions, in which one researcher interacted with a single child. The initial research was enough to convince the researchers that the cognitive models were, by themselves, insufficient to account for the children's mathematical learning. This study was conducted in a second-grade classroom at the rural/suburban site. The general instructional approach that the researchers together with the teacher had developed was problem-centered and reflected the constructivist tenet that students reorganize their ways of knowing to eliminate contradictions in the worlds of their personal experiences. The instructional activities were therefore designed to be personally problematic for children at a variety of different conceptual levels. Further, social interactions were viewed as a potential source of contradictions and an attempt was made to ensure that the children explain and justify how they had interpreted and solved tasks. In addition, the researchers placed a high priority on the development of

intellectual and social autonomy, and hoped that the teacher and children would together become a community of validators.

Contrary to the researchers' expectations, it soon became apparent that the teacher's pedagogical agenda conflicted with the beliefs that the children had developed during first grade about their own role, the teacher's role, and the general nature of mathematical activity in school. As a consequence, the teacher spontaneously began to guide the renegotiation of classroom social norms on her own initiative. For example, the following incident occurred during the first day of school when the teacher and children discussed solutions to the word problem, "How many runners altogether? There are six runners on each team. There are two teams in the race."

Teacher: Jack, what answer-solution did you come up with?

Jack: Fourteen

Teacher: Fourteen. How did you get that answer?

In this brief exchange, the teacher expected Jack to explain how he had interpreted and solved the problem. However, Jack seemed to interpret the teacher's question as a request for an answer, and presumably expected her to evaluate his reply. Instead, she accepted his answer without evaluation, and restated her initial question. This conflict in expectations indicates that the teacher was not merely attempting to elicit an account of Jack's solution but was also negotiating with him how to engage in mathematical discourse in her classroom. The episode continued:

Jack: Because 6 plus 6 is 12. Two runners on two teams... (Jack stops talking, puts his hands to the sides of his face and looks down at the floor. Then he looks at the teacher and then at his partner, Ann. He turns and faces the front of the room with his back to the teacher and mumbles inaudibly).

Teacher: Would you say that again. I didn't quite get the whole thing. You had say it, again please.

Jack: (Softly, still facing the front of the room.) It's six runners on each team.

Teacher: Right.

Jack: (Turns to look at the teacher). I made a mistake. It's wrong. It should be twelve. (He turns and faces the front of the room).

Once he realized that his answer was incorrect, Jack interpreted the situation as one that warranted acute embarrassment. In effect, he acted as though the teacher had publicly evaluated his answer. This further conflict in expectations confounded in the teacher's intention that the children should publicly express their thinking and, more generally, engage in mathematical practices characterized by conjecture, argumentation, and justification.

Thus far, Jack and the teacher had been talking about mathematics – the themes were Jack’s answer and his solution. At this point in the episode, the teacher initiated a new conversation in which she and the children talked about talking about mathematics. The issue of how to interpret situations in which a mistake has been made, made them become an explicit topic of conversation.

Teacher: (Softy). Oh, okay. Is it okay to make a mistake?

Andrew: Yes.

Teacher: Is it okay to make a mistake, Jack?

Jack: Yes.

Teacher: You bet it is. As long as you’re in my class it is okay to make a mistake.

Because I make them all the time, and we learn from our mistakes, a lot.

Jack already figured out, “Oops, I didn’t have the right answer the first time,”

(Jack turns and looks at the teacher and smiles) but he kept working at it and

he got it.

In contrast to exchanges in which the teacher and children talked about mathematics, this interaction fits the elicitation-reply-evaluation pattern of traditional classroom discourse, the evaluative statement being, “You bet it is.” Both here and on other occasions when she initiated the explicit renegotiation of classroom social norms, the teacher attempted to tell the children how they ought to interpret particular situations. In this case, she emphasized that Jack’s attempts to solve the problem were appropriate in every way, while simultaneously expressing her belief that it was more important in her classroom to

contribute to the discussion by explaining a solution than it was to produce correct answers. Observations made in this classroom later in the school year indicated that the interventions the teacher made to initiate and guide the renegotiation of classroom norms were generally successful.

As the sample episode illustrates, the classroom can be seen to be composed of two mutually supporting levels of conversation: (1) talking about mathematics, where the teacher and children negotiate mathematical meanings; and (2) talking about talking mathematics, where the teacher and learners negotiate their obligations and expectations for doing and talking about mathematics.

In the years following the completion of the first classroom teaching experiment, the researchers continued to analyze the mathematics traditions established in project classrooms and in conventional, textbook-based classrooms. The analysis indicated that the taken-as-shared mathematical practices established in traditional classrooms generally have the quality of what the researchers call procedural instructions. They are instructions in the sense that the consequence of transgressing them is ineffectiveness, rather than merely error per se. They are procedural in the sense that the symbols manipulated when engaging in classroom mathematical practices do not necessarily refer to anything beyond themselves.

As an illustration, one can consider the following episode, which occurred in a traditional third-grade classroom in the same school at the rural/suburban site with eight-year-old

children. The teacher and children were working through four textbook tasks that each involved a pictured collection of base-ten longs and individual cubes. One task showed three longs and six cubes.

Teacher: How many tens do you see? Monica?

Monica: ... [No response].

Teacher: [Problem] number three.

Monica: Three.

Teacher: How many ones do you see? James?

James: Four.

Teacher: Not in number three, James.

James: ...[Inaudible].

Teacher: Six. And what number is that, James?

James: Sixty.

At this point, James's and the teacher's interpretations of the task were clearly in conflict. A variety of possible ways in which the episode might have continued, can be imagined. For example, the teacher could have asked James to explain his response, or she could have asked the other children whether they agreed with his answer. Instead, their subsequent actions indicated that doing mathematics was, for them, a matter of following procedural instructions.

Teacher: Look at number three, James. How many tens do we see? (Moves toward him).

James: Three.

Teacher: And how many ones?

James: Six.

Teacher: And what number is that?

James: Sixty-three.

Teacher: Okay, let's look, James. Look, James, look. How many tens do we see? Three tens. How many ones? Six ones.

James: Thirty-six.

Teacher: Thirty-six. Good.

When the researchers consider what James learned in the course of this exchange, it seems unlikely that he constructed conceptual units of ten that were themselves composed of ones. In all likelihood, he found a way of producing an answer that was acceptable to the teacher by focusing on the number words “three” and “six”. Thus it appears that the teacher was unknowingly guiding his construction of a procedural instruction that did not refer to anything beyond itself. We also note that the teacher had to pose increasingly specific questions before James gave a response that she could evaluate positively, and thus conclude the exchange. The consequence of James's error therefore seemed to be ineffectiveness in that he was unable to participate in the constitution of an elicitation-response-evaluation pattern that characterized smooth interactions in this classroom.

More generally, an analysis of public discourse in this and other conventional textbook-based classrooms gives no indication that symbol-manipulation acts developed within the

school mathematics tradition carry the significance of mentally acting on abstract yet personally real mathematical objects. Further, because there was nothing beyond the symbols to which the teacher and the children can publicly refer, an explanation in these classrooms involves stating a sequence of instructions for manipulating symbols. As a consequence, mathematics as it is interactively constituted in these classrooms, is a ritualistic, self-contained activity divorced from other aspects of children's lives, including their out-of-school pragmatic problem solving.

In contrast, in project classrooms, the manipulation of conventional symbols typically seemed to signify acting on taken-as-shared mathematical objects for the children. For example, in the second-grade classroom in which the first teaching experiment was conducted, children proposed 52, 42 and 48 as answers to a task that involved finding how many would have to be added to 38 to make a pictured collection of eight strips of ten squares and six individual squares (i.e., 86). The teacher framed this conflict in the children's answers as a problem that needed to be resolved: "So how are we going to figure this out? We've got three different answers." One group who gave 48 as their answer and explained their solution as follows:

Jason: We took away 50 [from the eight strips of ten], and we have 30 left, and then there is 6 [individual squares] here so we knew that wouldn't work so ...

Teacher: Right.

Jason: ...we have to take 2 off one of the ten bars [that we took away] and then add it to the 30, and that makes, and that, and that would make all up ... and that would

make 48 [that we have taken away].

Teacher: Forty-eight. Okay. Who did it a different way.

The metaphor of acting in physical reality was implicit in Jason's explanation, suggesting that he experienced numbers as arithmetical objects that were abstract, and yet had a manipulable quality. More generally, this metaphor of acting in physical reality permeated classroom discourse whether or not task statements involved pictures and diagrams.

As the episode continued, one child said that he agreed with 48, and that the teacher asked his small group partner, Chuck, for his opinion.

Chuck: I agree with 48.

Teacher: Why do you agree with that? I want you to explain it to me.

Chuck: Well, like ... (shrugs his shoulders).

Teacher: That's not a good enough answer, Chuck. Did you hear Chuck's answer? Look at me [to the class], this was Chuck's answer (shrugs her shoulders). That's not good enough.

Here, Chuck was ineffective even though he agreed with the correct answer. In contrast, children who could explain how they had arrived at what later proved to be an incorrect answer continued to be effective in this classroom. The teacher explicitly addressed this issue at the conclusion of the episode: "It doesn't matter if you have 48, 47, 49 or

whatever . . . It isn't the idea that your answer is right as much as how in the world are you gonna try to get an answer." Thus, the consequence of transgressing a mathematical norm in this classroom was error per se rather than ineffectiveness.

More generally, the sample episode illustrates that to be effective in an inquiry mathematics classroom is to engage in mathematical argumentation. As part of this process, students are obliged to give explanations and justification that others might be able to interpret in terms of actions on mathematical objects. It also appears that the teacher and the children in an inquiry mathematics classroom are acting in a taken-as-shared mathematical reality, and that they elaborate this reality in the course of their ongoing negotiations of mathematical meanings. To say that their negotiations are about the nature of such reality is to say that generally accepted arguments established mathematical truths rather than specify procedural instructions.

In a school mathematics classroom, the focus seems to be on a self-contained, esoteric form of communication that involves the linking together of conventional written and oral symbols. In an inquiry mathematics classroom, the teacher and learners elaborate a taken-as-shared mathematical reality in the course of their interactions – their personal experience is that of coming to know an objective mathematical reality.

Another empirical research that is related to the present study was conducted by Perry, VandeKamp, Mercer and Nordby (2002). Their program of research had two objectives: to identify features of classroom tasks, authority structures, and evaluation practices that

support young children's development of independent, academically effective forms of reading and writing, and to work collaboratively with teachers to design literacy activities that contain these features. Over the past five years, these researchers have taken a multipronged approach to meeting these objectives. First, they observed classrooms over a period of time and characterized them as high or low in promoting self-regulated learning (SRL). Next, the researchers worked with primary teachers, supporting their efforts to create literacy environments for their learners that were "high-SRL". Finally, they went into classrooms to observe teachers' innovations, and to document their impact on learners' engagement in learning.

As part of a multiple and embedded case study, Perry observed literacy activities in five Grade 2 and 3 classrooms. These classrooms were selected from a larger pool of classrooms in a suburban school district in British Columbia. The observations, which took the form of running records, occurred weekly for 6 months (January through June), during regularly scheduled reading and writing activities in the classrooms. Based on these observations, three of the classrooms were characterized as high-SRL classrooms. The other two classrooms were regarded as low-SRL classrooms. In these classrooms, students were engaged in simple, closed activities, which often focused on specific skills apart from authentic reading and writing (e.g., correcting spelling and punctuation errors in a sentence the teacher wrote on the board). Challenge and criteria for evaluation were controlled by the teacher and were typically the same for all students. Teachers' support in these classrooms typically targeted the procedural aspects of task completion (e.g.,

giving directions, distributing materials). There were few opportunities in these classrooms for learners to develop or engage in SRL.

The characteristics of the high-SRL classrooms - what teachers said and did in these classrooms – became the target of the work that the above mentioned researchers covered with the teachers.

In the spring of 1997, primary teachers from the same suburban district that was used in Perry's original study were invited to join an action research group with a shared goal to develop tasks and assessments that would reflect "best practices" in early literacy instruction. The group met for the first time on April 10, 1997, and included 10 primary teachers, 3 school-based remedial-resource teachers, 1 district curriculum consultant, and 2 university researchers (who are also teachers). This group stayed fairly constant through June 1998. In total, the researchers worked with 16 teachers who reflected a range of teaching experience (2-20 years), educational backgrounds, and beliefs about what constitutes effective literacy instruction for young children. In September 1998 through June 1999, the work was done with subset of five teachers from the larger group who were particularly interested in and adept at structuring tasks and interacting with students in ways that promote SRL. The observations that are presented in this empirical research are from their classrooms.

The researchers visited classrooms and observed the teachers' implementations of innovations they had designed to help their learners become more mindful and

independent about their reading and writing. To document the efficacy of the teacher development and in-class activities, the researchers collected teachers' free writes, video-taped air time and focus group discussions, collected samples of the tasks and assessments the teachers developed. Classrooms were observed, learners interviewed, and teachers were asked to rate their learners' motivation and achievement, and the collection of samples of learners' work was done.

The observation instrument used in this study was adapted from Perry. It has three sections. The first provides space to record (a) whose classroom is being observed, in what school, and at what grade level, (b) who is observing, (c) the date of the observation, and (d) the nature and duration of the activity in which teacher and students are engaged during that observation. The second section provides space to keep a running record of "what was going on," including verbatim samples of teachers' and students' speech. The third section lists categories, derived from previous investigations, that distinguish high- and low-SRL environments, including (a) types of tasks (open or closed), (b) types of choice, (c) opportunities to control challenge, (d) opportunities for self-evaluation, (e) support from the teacher (instrumental vs. procedural), (f) support from peers, and (g) evaluation practices (mastery- or performance-oriented). This list of categories provides a conceptual framework for observing in classrooms and then coding those observations.

During each observation, the researchers position themselves so that they can clearly see and hear the teacher and students without being intrusive. They record events and actions,

including a list of times related to events and actions, and, as much as possible, verbatim speech in teacher-learner and learner-learner interactions.

Drawing on the list of categories in the third section of the running record, the researchers identify instances of teachers' speech and actions during each observation that are believed to promote SRL (e.g., giving choices, engaging learners in various forms of self-evaluation). Next, the researchers assign each running record a rating of 0 or 1 for each of the overarching categories (e.g., choice, challenge, self-evaluation) to indicate the presence or absence of that quality in the activity. These ratings were entered in a summary table for each class to generate a profile of the consistency with which reading and writing activities in that classroom are high-SRL across multiple observations.

Two representative running records were selected from two of the five classrooms which were observed during the 1998-1999 school year. One of the running records describes PM's kindergarten and Grade 1 class. The second running record describes MH's Grade 1 and 2 class.

The findings of this study show what PM and MH did in their classrooms to promote SRL. The researchers discovered that such teachers gave learners choices, opportunities to control challenge, opportunities to evaluate their own and others' learning, instrumental support, and feedback and evaluation that was non-threatening and mastery-oriented.

The link between theoretical framework and teaching and learning of Mathematics indicates that self-regulated learning can be promoted in class through the use of different strategies. Such strategies can involve scaffolding by an educator or a peer. Learners need to be encouraged to work together. That can be achieved through the use of group work in class. Providing learners with opportunities for discovering solutions for themselves also assist them in becoming self-regulated. Observing of peers who are successful in solving mathematics problems can be motivating for students who experience problems in the subject. Two studies presented in the literature review, prove that it is possible to promote self-regulated learning in the classrooms.

CHAPTER THREE: RESEARCH DESIGN AND RESEARCH METHODOLOGY

3.1 Qualitative Research Methodology

A qualitative approach was used in this study. Yin (1994) cited in Butler (2002) argued that an optimal time to use qualitative methods is when it is not possible to separate a phenomena from its context. It could be argued that understanding self-regulated and supportive contexts presents such an occasion. Qualitative methods are particularly well-suited for examining instances of self-regulated learning as events because they involve rich, holistic descriptions, emphasize the social settings in which the phenomena are embedded, do not make assumptions about intra-individual stability, and are oriented to revealing complexity.

Neuman (2000:122) stated that qualitative researchers speak a language of “cases and contexts”. They emphasize conducting detailed examinations of cases that arise in the natural flow of social life. This author further argued that qualitative researchers emphasize the human factor and the intimate firsthand knowledge of the research. They avoid distancing themselves from the people or events they study.

According to Neuman (2000) qualitative research has the following characteristics:

Capture and discover meaning once the researcher becomes immersed in the data.

Concepts are in the form of themes, motives, generalizations and taxonomies.

Measures are created in an ad hoc manner, and are often specific to the individual setting or researcher.

Data are in the form of words and images from documents, observations and transcripts.

Theory can be causal or non causal and is often inductive.

Research procedures are particular and replication is very rare.

Analysis proceeds by extracting themes or generalizations from evidence and organizing data to present coherent, consistent picture.

In this study, a qualitative case study approach was used.

3.2 The Case Study

Cohen & Manion (1997) stated that unlike the experimenter who manipulates variables to determine their causal significance or the surveyor who uses standardized questions of large, representative samples of individuals, the case study researcher typically observes the characteristics of an individual unit - a child, a clique, a class, a school or a community. In this study, Grade 8 mathematics class was the unit of analysis.

Cohen, Manion & Morrison (2000) stated that case studies strive to portray “what it is like” to be in a particular situation, to catch the close-up reality, and thick description of participants’ lived experiences, thoughts about and feelings for a situation. Hence, it is important for events and situations to be allowed to speak for themselves rather than to be

largely interpreted, evaluated or judged by the researcher. In this respect, the case study is akin to the television documentary. This is not to say that case studies are unsystematic or merely illustrative, case study data are gathered systematically and rigorously.

Stake cited in Vos, Strydom, Fouche & Delpont (2002) mentioned that the sole criterion for selecting cases for a case study should be “the opportunity to learn”. This study sought to examine the issue of self-regulated learning in the Mathematics classroom. Within the South African education system, this topic has not been explored adequately. In embarking on this study, I hoped to make a contribution to the field of Mathematics teaching and learning in South Africa.

According to Vos, Strydom, Fouche & Delpont (2002) the exploration and description of the case takes place through detailed, in-depth data collection methods, involving multiple sources of information that are rich in context. In this study, data collection was done through observations and interviews.

3.2.1 Observation

Cohen, Manion & Morrison (2000) state that whatever the problem or the approach, at the heart of every case study lies a method of observation. According to these authors, there are two principal kinds of observation in case study – participant and non-participant observation. In the former, observers engage in the very activities they set out to observe. In non-participant observation, on the other hand, the observer stands aloof

from the group activities they are investigating. The best illustration of the non-participant observer role is perhaps the case of the researcher sitting at the back of a classroom, coding up every three seconds the verbal exchange between teacher and pupils by means of structured set of observational categories. In this study, I played a role of the non-participant observer.

Bailey (1987) points out that the major problem with overt observation is that it may be reactive. That is, it may make the subjects ill at ease and cause them to act differently than they would if they were not being observed. According to Gormly (1992) naturalistic observation, sometimes done through a one way window or mirror, is a useful technique for studying teaching methods and classroom interactions because the observer does not distract the students or the teacher, and perhaps cause them to alter their behavior.

However, Patrick & Middleton (2002) suggested that observational research is useful because it can portray learners' actions rather than their recollections or beliefs, can document how pattern of student engagement in academic tasks unfold over time, and is sensitive to the environment in which the events occur. These authors further suggested that observations are limited to examination of behaviors, and provide limited insight into how individuals make sense of events. Open-ended interviews may complement observations because they allow respondents to reveal and explain events and experiences in their own words and from their own perspectives. Therefore, a semi-structured interview was also used in this study.

3.2.2 Interviews

Kvale (1996) is of an idea that if you want to know how people understand their world and their life, you have to talk to them. According to this author, in an interview conversation, the researcher listens to what people themselves tell about their lived world, and hears them express their views and opinions in their own words, learns about their views on their work situation and family life, their dreams and hopes. The qualitative research interview attempts to understand the world from the participants' point of view, to unfold the meaning of peoples' experiences, to uncover their lived world prior to scientific explanations.

According to Kvale (1996) there is a move away from obtaining knowledge primarily through external observation and experimental manipulation of human subjects, toward an understanding by means of conversations with the human beings to be understood. The participants not only answer questions prepared by an expert, but themselves formulate in a dialogue their own conceptions of their lived world. The sensitivity of the interview and its closeness to the participants' lived world, can lead to knowledge that can be used to enhance the human condition.

Vos, Strydom, Fouche & Delport (2002) mentioned that in general, qualitative researchers use semi-structured interviews to gain a detailed picture of a participant's beliefs about, or perceptions or accounts of a particular topic. The method gives the

researcher and participant much more flexibility. The researcher is able to follow up particular interesting avenues that emerge in the interview, and the participant is able to give fuller picture. With semi-structured interviews, the researcher will have a set of predetermined questions on an interview schedule. The interview will be guided by the schedule rather than be dictated by it. The participant can introduce an issue the researcher had not thought of. In this relationship, the participant can be perceived as the expert on the subject, and should, therefore, be allowed maximum opportunity to tell his/her story

3.3 The school context

The research for this study has been done at Khula High School which is situated at Magabheni near Umkomaas in KwaZulu-Natal. The total enrolment of the learners is more than one thousand, from Grade 8 up to Grade 12. The learner population consists of only Black African learners.

Mathematics falls under the Department of Science which has one Head Of Department (HOD). There are five teachers who teach mathematics, excluding the HOD. Three female teachers take the mathematics junior classes which are Grades 8, 9 & 10. The remaining two teachers, male and female, are responsible for the senior mathematics classes. The focus of this research is on Grade 8 mathematics.

3.4 The Research Process

3.4.1 Participants in the study

The participants for the research consisted of Grade 8D learners and one educator.

Initially, the aim of the researcher was to observe two Mathematics classes, that is, Grade 8A taught by Mrs Dladla, and Grade 8D taught by Mrs Mkhize. Mrs Dladla is only in charge of one Grade 8 Mathematics section, which is Grade 8A. The remaining three sections are taken by Mrs Mkhize. I decided to observe the first and the last sections in Grade 8 so as to accommodate both teachers. This is regarded as purposeful sampling. According to De Vos (1998) this type of sample is based entirely on the judgement of the researcher, in that the final sample is composed of elements which contain the most characteristics, representative of typical attributes of the population. Unfortunately, Mrs Dladla could not be part of the research because she was hospitalized at the time of data collection. That is how I ended up with only one class to observe.

The principal of the school was informed about the research. Permission to conduct the research was not immediately granted. The school principal first informed the educator that was going to be involved in the research that she had been selected to be part of the present study. The principal asked her if she was willing to let me observe her lessons in Grade 8 mathematics class. She agreed. The principal then gave the researcher the opportunity to talk to the educator about the purpose of the study and what it was that I

would be doing in her class. The educator informed Grade 8D learners about the research that I was going to do in their classroom.

The researcher did not decide about the type of lessons to observe. It just happened that at the time of observation, Grade 8D class was going to deal with the section about the angles of a triangle.

3.4.2 The participants

Eight Mathematics lessons were observed in Grade 8D class. The learners' books were also analyzed to supplement the data obtained through lesson observations. The learners' books consisted of class-work exercise books, assignment, test exercise books and portfolios.

Mrs Mkhize is the educator in charge of Grade 8D Mathematics class whose lessons were observed. This educator was also interviewed with an aim of obtaining data that could be used to supplement the information gained through lesson observations.

CHAPTER FOUR: PRESENTATION OF FINDINGS

4.1 Introduction

In this chapter the results of the study are presented. As mentioned in chapter three, the data was collected through the observation of Grade 8D mathematics lessons, semi-structured interview with the mathematics educator of the class whose lessons were observed, and document analysis which consisted of learners' and educator's books.

4.2 Data analysis approach

The observation instrument used in the present study was adopted from Perry, VandeKamp, Mercer & Nordby (2002). This instrument has three sections. The first provides space to record (a) whose classroom is being observed, at what school and at what grade level, (b) who is observing, (c) the date of the observation, and (d) the nature and duration of the activity in which teachers and students are engaged. The second section provides space to keep a running record of "what was going on", including verbatim samples of teacher's and students' speech. The third section lists categories, derived from previous investigations, that distinguish high and low SRL environments, including (a) type of tasks (open or closed ended), (b) types of choice, (c) opportunities to control challenge, (d) opportunities for self-evaluation, (e) support from the teacher (instrumental vs procedural), (f) support from the peers and (g) evaluation practices (mastery or performance oriented). This list of categories provides a conceptual framework for observing in classrooms and then coding those observations. However,

observers are encouraged to refine and expand these categories through their observations (Perry, VandeKamp, Mercer & Nordby, 2002). In this study, more information has been added on the categories presented in the original study. This was done to make the categories more suitable for the analysis of the mathematics lessons.

The following information indicated how the data gathered in eight mathematics lessons was analyzed:

Data Analysis Schema:

Offered Choices: Did the teacher give opportunity to the learners to:

- Set the level of challenge.
- Choose different strategies.
- Find alternate or different solutions
- To relate to everyday experiences or events

Offered opportunities to control challenge.

- Modify the demands of tasks.
- Give the learners choices
- Placed demands on students according to the teacher's goals and expectations for them.

Type of Tasks.

- Open or closed ended tasks.

Teacher Support.

- Creating unthreatening environment even if the answer is wrong.
- Scaffolds solution finding process.
- Setting students to link with prior knowledge.

Self and other Evaluation**Did the teacher give the opportunity to learners to:**

- Explain how they arrive at their solution.
- Evaluate the work done by the others.

Peer Support

- Allowing student to assist each other when solving the problems.

Teacher Evaluation

- Correction of errors used as the opportunity to learn.
-

In this study, eight mathematics lessons were observed in a Grade 8D class. Like in the original study, the analysis of the running records focus on what the teacher says and do to promote SRL and on evidence that students are responding. Drawing on the list of

categories in the third section of the running records, the researcher identified instances of teacher's speech and actions during each observation that are believed to promote SRL, (e.g. giving choices, engaging learners in various forms of self-evaluation). This was done across the eight lessons observed.

Table 4.1 presented below, shows the frequency a category was noted across observations in eight mathematics lessons. The categories that distinguish high and low SRL classes are the following: giving students choices, engaging students in various forms of self-regulation.

Table 4.1

Summary of ratings for mathematics lessons observed in Grade 8 mathematics class

CATEGORIES	1	2	3	4	5	6	7	8
Open tasks activities	4	3	0	0	0	0	0	0
Choice	2	4	4	1	2	0	2	0
Self evaluation	0	1	4	3	3	1	5	2
Peer evaluation	2	0	6	0	1	1	3	5
Teacher evaluation	3	2	2	2	4	1	6	1
Teacher support	6	3	3	6	11	9	4	4
Peer support	3	2	5	3	2	3	2	2

In the first lesson, learners were presented with four open tasks activities whereas in the second lesson, the learners had three open tasks activities. From the third to the eighth lessons, learners were not offered with any open task activities. The activities that they were provided with, pushed them in obtaining the same solutions.

Two opportunities for choice were offered to the learners in the second lesson. The learners had four opportunities for choice in the second and third lessons. In the fourth lesson, they had only one opportunity. During the fifth and the seventh lessons, they had two opportunities for choice. Opportunities for choice were not offered during the sixth and eighth lessons.

In the first lesson, the learners had no opportunity for self-evaluation. During the second and the sixth lessons, they had only one opportunity for self-evaluation. In the third lesson, the learners had an opportunity to evaluate themselves four times. Three instances of self-evaluation occurred in the fourth and the fifth lessons. During the eighth lessons, only two opportunities for self- evaluation were made available to students.

Learners were able to evaluate their peers twice in the first lesson. In the second and fourth lessons, no peer evaluation took place. Six opportunities for peer evaluation occurred in third lesson. In the fifth and sixth lessons, peer evaluation took place only once. In the seventh lesson, the learners had a chance of evaluating their peers three times. Peer evaluation occurred five times in the eighth lesson.

Three instances of teacher evaluation were observed in the first lesson. Teacher evaluation occurred twice during the second, third and fourth lessons. The teacher evaluated the learners' work four times in the fifth lesson. Teacher evaluation only took place once in the sixth and the eighth lessons. During the seventh lesson, teacher evaluation occurred six times.

In the first and fourth lessons, teacher support was observed six times. During the second and third lessons, the teacher offered support to the learners three times. Eleven instances of teacher support were observed in the fifth lesson. In the sixth lesson, teacher support was observed nine times. During the seventh and the eighth lessons, teacher support occurred four times.

Peer support was observed three times in the first, fourth and the sixth lessons. Peer support occurred twice in the second, fifth, seventh and eighth lessons. In the third lesson, peer support was observed five times.

4.2 Lesson observation

The running record from Mrs Mkhize's class describes what happened in eight mathematics lessons that were about triangles. The first lesson observed was about the introduction of triangles. In this lesson, the educator wanted the learners to recall what they know about triangles. This involved defining a triangle, naming and measuring the angles of triangles. The learners were able to achieve this with the help of the educator

and the peers. The second lesson involved the work about the angles of a triangle. In this lesson, the learners were presented with the work, which enabled them to discover the sum total of the angles in a triangle. The learners had to discover that on their own. In the third lesson, the learners were expected to show that they know the different types of triangles.

The fourth, fifth and the sixth lessons were about the calculation of unknown angles in a triangle. In these three lessons, the educator, together with the learners were involved in solving the problems. The learners took turns writing corrections on the board. The educator came in and assisted if the learners showed some difficulties.

The seventh activity was about the exterior angle of a triangle. This activity made it possible for the learners to discover the relationship between the exterior angle and the sum total of the two interior opposite angles of a triangle.

Activity eight, involved the work about the angles of an isosceles triangle. In this activity, the learners were expected to discover for themselves the information about the angles of such triangles. They were expected to discover that on their own.

4.2.1 What did teachers do and say to promote SRL?

I have used five overarching categories from the observation protocol to organize what Mrs Mkhize did to support SRL. These were giving learners choices, opportunities to

control challenge, opportunities to evaluate their own and others learning, instrumental support, feedback and evaluation that was non-threatening and mastery-oriented. This presentation will cover what took place in eight mathematics lessons observed.

4.2.1.1 Offered choices

According to Eshel & Revital (2003) granting learners opportunities for choice may enhance their intrinsic motivation, as well as their investment in learning.

In the first lesson, the learners were given a choice of using their own alphabetical letters to name the angles of a triangle. On the very same activity, for homework, they were asked to draw four different triangles. They were not told about the type and size of triangles to draw. In the second lesson, the learners were still asked to work with triangles they have drawn on their own. The learners also had an opportunity to choose a group that they would like to work with. When presenting their responses, the learners were asked to state them in a sentence form, but one boy just stood up and mentioned his response. The educator accepted that. Toward the end of activity two, the learners were also asked to draw two more triangles. Again, they were not told about the size of triangles they had to draw. They had to decide about that on their own.

In the third activity, the learners were given a choice to draw a diagram to explain their answers if they wanted to. In one question, they were asked to explain if it is possible to get a right angle equilateral triangle. Given a choice of making drawings to explain their

answers, the learners observed practically that it is not possible to get such a triangle. Also in this activity, a girl was given the choice of writing her solution on the board. Another girl told the educator that she could not explain in words what an isosceles triangle is but was prepared to make a drawing of such a triangle on the board. The educator agreed to that.

In the fourth lesson, the learners were offered with the choice of deciding where they could start simplifying the given problem. Since this was the first problem that required them to calculate the sizes of unknown angles in a triangle that challenged them to think. One girl was allowed to first draw a geometrical figure of her problem on the board before simplifying it.

In the fifth lesson, one learner was given a choice of explaining his solution in Zulu. This made the learner feel comfortable when presenting his response. Again, during this lesson, a girl was given a choice of first solving a problem with her group before writing the solution on the board.

In the sixth lesson, learners were not offered with any choices. In the second problem the learners could have been offered with the choice of first getting the size of angle y when solving the problem. This could have been done to prove that there was an alternative method of solving the problem.

In the seventh lesson, learners were presented with a choice of first doing their calculations on the piece of paper before filling their answers in the table. Towards the end of this lesson, one boy was offered with a choice of writing his group's solution on the board. In the eighth lesson, learners were not offered any choice.

4.2.1.2 Offered opportunities to control challenge

In the first lesson, the educator challenged the learners by telling them that she would like to have one learner draw a big triangle on the board. Still in this lesson, the learners were asked if they have ever seen road signs that have triangular shape. The learners were also requested to write on the board how the angles of a triangle can be named. The learners were asked to draw and name the angles of a triangle. The educator told them not to use the alphabetical letters that were already on the board. For homework, in this lesson, learners were asked to draw four different triangles in their exercise books, measure their angles, and then find the sum total of the three angles of a triangle.

In the second lesson, the educator discovered that some learners did not complete their homework. These learners were given time to complete their work in class. When everyone finished, the homework was then corrected. In the second part of the lesson, the learners were presented with an activity, which required them to work in pairs. In a pair, one member had to use a ruler to draw a fairly large acute-angled triangle. Then, a drawn triangle had to be cut out. Another member of a pair had to draw a fairly large obtuse-angled triangle. For each triangle, the angles had to be coloured and the vertices needed

to be marked clearly. Then the learners were asked to tear off each corner of a triangle, and arrange them with the points and edges touching. The educator then asked them to name the special angle that has been formed.

In the third lesson, the learners were asked to state what they had noticed if the three angles of a triangle were added together. This was the continuation of the activity done in lesson two. In this lesson, the learners worked in groups but the educator stressed that all the members in a group had to contribute in trying to solve the problem.

In the fourth lesson, the learners had to calculate the sizes of unknown angles in a triangle. The educator asked them to look at the example provided in the book. She asked the learners to try and figure out where they could start simplifying the problem. The learners were also told that they would have to write the solutions of their problems on the board.

In the fifth lesson, the learners were still writing corrections on the board. They were asked to mention the properties of an equilateral triangle. In the sixth lesson, the learners were still required to calculate the sizes of unknown angles in a triangle. The first problem had two triangles, a big and the small one. The girl who wrote the solution on the board did not realize that it had two triangles. She only solved one. The educator told the class that she needed someone who will solve the second triangle.

In the seventh lesson, the learners were asked to use their knowledge of the sum of the angles of a triangle, and the sum of adjacent angles on a straight line to complete the table. In the eighth lesson, the first part required the learners to correct the homework. They were asked to mention what they had observed about angles $b + c$ and d . When they finished marking the homework, the learners were presented with another activity. When the work was completed, the learners were asked to mention what they had discovered about the base angles of an isosceles triangle. In this activity, the learners were asked to do the following:

- (a) You and your partner must each draw a fairly large isosceles triangle. Remember that it must have two equal sides.
- (b) Cut out your triangles and fold them down the middle so that the equal sides match exactly.
- (c) Discuss with your partner what you notice about the two base angles.
- (d) Discuss what you notice about the angles on the fold line.

As pointed out earlier in chapter two, that one important historical change in the way people look at teaching is that now people emphasize that a teacher's main role is to facilitate learning rather than to be a source of all knowledge. This means that teachers have to help learners construct their own knowledge, rather than simply telling them things they are expected to memorize (Killen, 2000). When one looks at what was taking place in these eight lessons, it becomes clear that the educator provided the learners with the activities that required them to think. Most activities that the learners were presented with, required them to discover information on their own. Pape (2002) believes that

students should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort, and should then be encouraged to reflect on their thinking. Mathematics instruction should, for example, enable students to apply and adapt a variety of appropriate strategies to solve problems, and to monitor and reflect on the process of mathematical thinking.

4.2.1.2 Offered opportunities for students to evaluate self and others

According to Pape (2002) classrooms in which learners expect to provide an explanation and a justification for their responses facilitate the development of mathematical thinking and SRL. When thinking is articulated regularly, patterns of thinking develop that are iterative. Thinking cannot be articulated unless learners reflect on the problem and the strategies they use to solve it. The educator tried to let the learners to explain how they have arrived at their solutions. This made it possible for the learners to think about the methods they have used to solve the problems. As explained earlier, such dialogues enable students to be exposed to strategies used by their more sophisticated peers and to ways of thinking that may be different from their own. These dialogues produce within them a stance toward learning that is consonant with SRL theory from an educational psychology perspective. It facilitated necessary forethought, self-monitoring and self-reflection that are crucial to self-regulation. Most importantly, when both learners and teachers are expected to provide verification for their thinking, it provides the models that are imperative for the development of self-regulation. All learners may begin to imitate these ways of thinking as they progress toward self-regulation (Pape, 2002).

In the first lesson, the educator asked the other members of the class if they do agree that a triangle is a three- sided figure. They were also asked if they agree that a triangle has three angles.

In the third lesson, the learners were asked to state what they had observed if the three angles of a triangle are added together. The other learners in class were asked to state if they agreed with the given response which was that the size of a straight angle is 180 degrees. The following are some of the questions that the learners were supposed to answer in the activity during this lesson:

-Is it possible for a triangle to have

- more than one obtuse angle
- more than one right angle
- more than one acute angle

The learners were asked to explain each of their answers

-Which angle in a right angle triangle is the biggest? Why? What do you know about the other two angles.

-Is it possible to get a right angle equilateral triangle? Explain why/why not? Make a drawing of one if you think it is possible.

In the fourth lesson, the learners were asked to calculate the sizes of unknown angles in a triangle. They were presented with problems that they were supposed to solve in class. When they finished doing that, they were asked to write their solutions on the board. One boy volunteered to solve the first problem on the board. When he finished writing his solution, the educator asked him to explain why he has added 72 and 40 degrees together. The educator also asked the learners to explain why was 112 degrees subtracted from both sides of the equation.

Still in the fourth lesson, a girl solved the second problem on the board. When she finished doing that, the educator asked her some questions.

Educator: In the equation there is 90 degrees but looking at your triangle, there is no 90 degrees. Will you please tell us how you get the 90 degrees that is in your equation.

In the fifth lesson, the learners were still calculating the sizes of unknown angles in a triangle. The solutions were written on the board, by the learners. One boy wrote the solution on the board. The educator asked him to explain how he arrived at his final step.

Educator: In the triangle there is only one x but in your solution you have two x's. Where has the other x come from? In step number five of your solution, you divided both sides by two. Why?

When the learners finished solving the two triangles on the board, the educator asked them to explain what they have noticed about them. The educator asked the boy who solved the problem to explain to the whole class how they managed to solve it in his group.

In the sixth lesson, the learners were still calculating the sizes of unknown angles in a triangle. One girl volunteered to write the solution on the board. When she finished doing that, the educator asked the other learners if they were happy with the given solution. The second problem was solved by a boy on the board. When he finished writing his solution, the educator asked the other learners if they agreed with his solution.

In the seventh lesson, the learners were asked to complete a table. One boy gave the first response. In the table, for angle c he wrote 60 and for angle d, he wrote 100. The educator asked him to make some explanation.

Educator: Will you please tell us how you get 60 for angle c?

Boy: Madam, the angles of a triangle add up to 180. Therefore, $80 + 40 + c = 180$. Then I added the like terms together and I get $120 + c = 180$. To have c as a subject of the formula, I subtracted 120 from both sides of the equation.

Educator: Good. (Looking at the whole class). Did you all managed to get 60 for angle c?

The educator also asked the learners to state what they have noticed about angles $b + c$ and d .

The first part of the eighth lesson, required the learners to complete the work set the day before. They were still expected to state what they had noticed about angles $b + c$ and d .

The second part of the lesson, required the learners to complete the activity about isosceles triangles. One response that came from a pair was that the angles on a folded line are equal. The educator did not just accept their answer, instead she asked them, "What made you and your partner conclude that the two angles are equal?"

4.2.1.2 Provided instrumental support through self and peers

In the first lesson, the educator told the learners that as they moved around, they must take notice of objects with triangular shapes. In this lesson, the learners were reminded by the educator that in their previous lessons, they did cover the work which required them to use protractors to measure the sizes of unknown angles. When the learners were busy with their work, one group told the educator that they were not able to measure the sizes of angles with a protractor. The educator asked the class if there was anyone that was prepared to help. No one volunteered. The educator then went to the group with the problem and helped them. During the course of the lesson, this group assisted the other class members that were experiencing problems.

In the second lesson, there were some learners who did not complete their homework. The educator gave them a few minutes to try and complete their work in class. In the second activity, the learners were asked to mention the size of a straight angle. Few learners indicated that they want to respond to the question. The educator reminded them that in their previous lessons, they did cover the work about straight angles. Therefore, she expected them to try and recall what they have learnt.

At the beginning of the third lesson, the learners had to correct their homework. They were asked to mention what they had noticed if the three angles were added together. One learner stated that the angles form a straight angle and the size of a straight angle is 180 degrees. The learners also stated that such angles are the adjacent supplementary ones. When responding to the next question which was: "Is it possible for a triangle to have more than one obtuse angle?" One group mentioned that it is possible for a triangle to have more than one obtuse angle. Other groups shouted "no". One girl stood up and said that an obtuse angle has a size that is more than 90 degrees. If there can be more than one obtuse angles in a triangle, that will make a sum total of angles that is more than 180 degrees. The educator also stressed that it is not possible for a triangle to have more than one obtuse angle.

At the beginning of the fourth lesson, the educator reminded the learners that they were going to calculate the sizes of unknown angles of different triangles. She also told them

that in their previous lessons, they did calculate the sizes of unknown angles in adjacent supplementary angles.

Before the learners started to solve problems on their own, the educator asked them to first look at the example provided in the textbook. When the learners were asked if they understood what was in the example, some learners indicated that they did not. The educator went to the board, and made a drawing of the example that the learners were supposed to analyze. That was a triangle with two sizes provided, one had a size of 72 degrees, and the other one was 40 degrees. The other angle was marked with an x , meaning that its size was not known. The educator stressed that in the given problem the learners were supposed to calculate the size of an unknown angle.

While the learners were busy solving the problems, the educator noticed that some groups experienced difficulties. The educator told the learners that they were free to ask for help from the other groups. The learners started to move around, trying to get help from the other groups that already had the correct solution. The educator stressed that, those learners who were looking for help, must be provided with the information about how they can solve the problem. They were not just supposed to copy the correct work.

In the fifth lesson, the educator told the learner who has been absent that she must try to observe carefully what the other learners would do on the board. One boy wrote the solution of a problem on the board. When he got finished, the educator asked him to

explain how he has arrived at his solution, but he happened to have a problem expressing himself in English.

Boy: (He kept quiet for a while. He looked at the problem on the board and then looked at the educator). Can I explain in Zulu?

Educator: Yes, you can explain in Zulu if you want to.

One learner had solved the problem on the board. The educator asked him to explain how he had arrived at his solution. When their conversation was over, she looked at the whole class and said, "I hope that you have been listening carefully to our discussion. Is there anyone who is still not clear about how the problem was solved?" (The learners kept quiet). Then, let us move to the next problem.

One boy told the educator that he had experienced some problems when he was trying to complete his work at home. But he said that since he has been observing others solving problems on the board, he felt that he would not experience the same difficulties again. The educator stressed that those learners who could not solve the problems correctly on their own, must observe carefully what the other learners do on the board. She also encouraged the learners to ask questions if there was anything they were not clear about.

During the sixth lesson, the learners were still writing the corrections of their work on the board. One girl volunteered to solve the first problem. When she finished doing that, another boy in class told the educator that the solution was incomplete. He said that the

geometrical figure had two triangles but the girl had only solved one triangle instead of two. That suggestion made it possible for the girl to realize her mistake, and she solved the remaining part of the problem.

One boy solved the second problem on the board. When he finished, another learner told the educator that the answer that was on the board was incomplete. He stated that what was missing was the size of angle y . The educator allowed him to write the remaining part of the solution on the board.

When the learners were asked to solve the last problem in this lesson, they indicated that they had difficulties. No learner was willing to solve the problems on the board. The educator told the learners that the problem which they were supposed to solve was similar to the one that had angles on a straight line. She wanted them to be aware that the problem which appeared to be difficult was similar to the one that they have already solved.

In the seventh lesson, the educator told the class that in order to be able to complete the table correctly, they were supposed to use the knowledge that they have gained about the angles of a triangle and adjacent angles on a straight line.

In the first part of the eighth lesson, the learners were supposed to correct their homework. When doing that, the educator discovered that some learners did not finish their work. The educator gave them a few minutes to complete solving their last problem.

When the learners finished doing their work, it was then marked. The second part of this lesson, required the learners to discover some information about the angles of an isosceles triangle. When the educator asked them to mention what they had discovered about the angles of an isosceles triangle. The learners just were quiet. The educator told them that in an isosceles triangle, the angles opposite equal sides are equal. However, I felt that the educator should not have provided the learners with that answer because the activity that they had completed provided them with enough information that they could have used to answer the question

Gultig (2001) pointed out that learners must build their own tower of knowledge, but if the teacher does not provide the scaffold, they cannot extend their knowledge beyond what they already know. This author further states that all learning is about bridging gaps. Scaffolding by teachers enables learners to extend their knowledge, and try something that they would otherwise not manage on their own. According to Berk (2000), the Vygotskian classroom goes beyond independent discovery, it promotes assisted discovery. Teachers guided children's learning, carefully tailoring their interventions to each child's zone of proximal development. Assisted discovery is also fostered by peer collaboration. Classmates with varying abilities work in groups, teaching and helping one another. One can argue that this is what has been happening in the eight lessons observed, in some instances the educator did not grasp opportunities.

McCaslin & Good cited in Meyer and Turner (2002) indicated that the development and support of self-regulation occurs through reciprocal interaction among individuals and

social context elements. Such contextualized framework also infer reciprocity between teacher and learner that evolve through co-regulation. These authors believe that viewing classroom learning as a negotiated process between an individual and others and autonomy as a relationship, rather than an individual attribute, suggests that self-regulation may be better understood as a social process.

As stated earlier, Cobb, Wood & Yeckel (1993) cited in Pape (2002), mentioned that social constructivists espouse the perspective that mathematics is best learned within a social environment. Problem solving behaviours or ways of thinking that set the domain of mathematics apart from others are best developed within a particular classroom environment. As teachers maintain an environment in which the development of understanding is constantly monitored through reflection, students are more likely to learn to take responsibility for reflecting on their work, and make adjustments necessary when solving problems. This statement seems to be in line with what was suggested by the Department of Education (2001), that by the end of the General Education and Training (GET) band, the National Curriculum Statement aims to produce a lifelong learner who is:

- Confident and independent
- Literate, numerate and multi-skilled
- Compassionate, with a respect for the environment and an ability to participate in society as a critical and active citizen.

According to Gultig (2001) a teacher's active interest and support can make it easy for learners to make mistakes and try again. This has been the case with the mathematics lessons offered by Mrs Mkhize.

4.2.1.3 Evaluation was non-threatening and mastery oriented

The manner in which the evaluation of work was done in the eight lessons was non-threatening. It was also not punitive. The mistakes done in class were used as an opportunity to learn. In these eight lessons, the learners were actively involved in correcting their own work. They wrote the corrections of their work on the board which were evaluated everyone in class. The learners also marked their work with pencils. Other learners seemed to regard this as fun. They appeared to enjoy going to the board and solving the problems.

In the first lesson, whilst the learners were busy doing their work, the educator kept on moving around the class, checking if everyone was doing the work. She encouraged all the learners to participate in the activity that was being done.

The educator never told the learners that their solutions were not correct. Instead, she used to ask the other learners if they agreed with the given response. This made it possible for the learners to identify mistakes on their own. They were also able to help one another, though in some cases, the educator had to provide assistance.

In the second lesson, the educator checked if the learners had finished doing their homework. She discovered that certain learners had incomplete work. She did not shout at them, instead she gave them some few minutes to complete their work in class.

In the third lesson, the learners were asked to mark their work. A response obtained from one boy was that if the three angles are added together, they will form a straight angle and the size of a straight angle is 180 degrees. The educator asked the other learners if they agreed with the given response. Still during the third lesson, one girl drew an isosceles triangle on the board which was correct, the educator asked the other learners to applaud her by clapping their hands.

In the fifth lesson, the learners were asked to calculate the sizes of unknown angles in a triangle. On the board, the educator has drawn an equilateral triangle. The educator asked the learners if they knew the type of a triangle that was on the board. One learner provided a response.

Learner: Yes, I know the type of a triangle that is on the board.

Educator: What do we call this type of a triangle?

Learner: It is a triangle with three equal sides.

Educator: Yes, it is a triangle with three equal sides. What do we call it?

Learner: (She kept quiet and began to look at the members of her group).

Educator: Do you need some help?

Learner: Yes.

Educator: (Looking at the whole class). Is there anyone who know the name of a triangle that is on the board?

In the sixth lesson, when a learner finished solving a problem on the board, the educator asked, "If $x = 36$, what is the size of an angle marked with $3x$?"

In the seventh lesson, the learners were required to complete a table. Whilst the learners were busy with their work, the educator moved around the class, checking if the learners were doing their work. At the end of the lesson, the educator asked the learners if they have enjoyed the activity that they have been doing.

In the eighth lesson, the learners were doing an activity which required them to discover information about the angles of an isosceles triangle. They were supposed to state what they had noticed about the angles on the fold line. One girl told the educator that together with her partner, they noticed that the two angles are equal.

Educator: (Looking at the girl). What made you and your partner conclude that the two angles are equal?

Perry, Van De Kamp, Mercer & Mordby (2002) argue that a hallmark of high self-regulated learning environment is that they challenge students without threatening their self-efficacy. According to Butler (2002) students' self-regulation can be enhanced or

inhibited by the circumstances in which they find themselves. The methods that the educator used to evaluate the work done by the learners made them feel at ease. They did not seem to be discouraged if they make mistakes, instead, in most cases the learners show the willingness to correct their mistakes once they were identified. The educator tried not to move to the next problem whilst there were still some learners who were experiencing problems. Most learners were not bashful to mention that they were left behind, that is, they did not understand how to solve the given problem. The educator and the other learners were always available to provide help in such situations.

In a study conducted by Glaserfeld (1998) it was discovered that if we repeatedly tell the children that their solutions to problems are wrong, we should not be surprised that their enthusiasm for tasks involving numbers dries up. If, instead, we ask children, "How did you go about getting this answer? What was discovered was that in many cases, learners are capable of seeing for themselves that something did go wrong. At that point, children become aware that *they* are capable of constructing solutions to problems, and that they themselves can decide whether something works or does not. This is the beginning of self-regulation, of a feeling of autonomy, and the start of active learning.

4.3 The Teacher Interview

A semi-structured interview was conducted in this study. Mrs Mkhize, the mathematics educator for grade 8D in whose class observations were conducted, was interviewed. The following information was gathered during the interview.

According to Mrs Mkhize, there are four grade 8 mathematics classes at her school but she teaches only three. She mentioned that the total number of learners in the three sections that she teaches is 180. There are more than 50 learners in each class. The educator stressed that she would be very happy if the number of learners could be reduced in classes, because that would enable her to provide individual attention to all learners with ease.

The teaching methods that the educator said she prefers to use most are question and answer and “group work”.

“ Not all the students are able to perform well when the question and answer method is used. The group work method is the one that seems to work well in class. This method enables the learners to discuss the work among themselves. They help one another to solve problems. Even very shy learners who are not free to ask the educator for help if there is something that they do not understand, benefit a lot from group work method. Learners feel free when they work with their peers”.

The educator mentioned that most learners co-operate well in class but there are some learners who like to play in class. As an educator, she always had to move around the classroom, checking if all the learners are doing their work. She said that the groups need to be monitored.

To motivate all the learners, I always try to provide help if the need arises. This makes the learners keep on trying when they are solving problems. The learners are also permitted to help one another in class.

Mrs Mkhize explained that there are learners who do not seem prepared to do their work, though their percentage is too low. To solve the problem, such learners are provided with individual attention. According to the educator, she has discovered that their learning problems are caused by factors outside the school.

These learners may have been physically or sexually abused. Some do not have parents. Many have parents who are unemployed. One cannot expect a hungry child to perform well at school.

The teachers are trying to help these learners. Those who are capable, donate clothes and food for such learners. On some

occasions, social workers have been consulted. To apply for grants from the government for such children becomes difficult because most of them do not have identity documents or birth certificates. Fortunately, people from Home Affairs Department came to school, and the learners together with the members of the community were allowed to apply for such documents at no cost.

Most learners perform well in Mrs Mkhize's mathematics classes. She believes that the Department of Education requirement that all the learners must pass mathematics if they are to progress to the next grade is good. This regulation makes learners take their work seriously, that is, they have learned to work hard. They know that if they fail mathematics, they will have to repeat the grade. This assessment requirement is that the work the learner covers during the course of the year counts 75% of the final mark. This is called continuous assessment. The assessment include: homework, class-work, assignments, projects and tests. This makes the learners realize that they have no time to waste because they now know that all the work that is done in class during the course of the year is important. The remaining 25% mark comes from the final examination.

The learners like the new pass requirement because we have made them aware that it will be easy for them to collect marks in class during the course of the year. This is possible because we

are always available to provide help. The learners also do benefit from assistance provided by their peers.

CHAPTER FIVE: CONCLUSION AND IMPLICATIONS

The critical question of this study was the following: Are we developing self-regulated learners in Grade 8 Mathematics classes?

Eshel and Kohavi (2003) stated that teachers have an important role to play in coaching the self-regulated learning of their students. According to Gultig (2001) when the Department of Education called for a new way of looking at learners, it spoke simultaneously of 'a new way of looking at teachers' in the context of outcomes based education (OBE). Traditionally, teachers had been considered to be deliverers of learning, whereas in OBE teachers were facilitators of learning. According to the national Department of Education teachers should now be:

'guides for the learning process, and not transmitters of knowledge'.

This general idea of teaching has gained respectability all over the world. Learning is understood to be much more meaningful when learners are allowed to experiment and reconstruct on their own rather than merely listen to the teacher lecturing. It follows that the teacher should in any learning situation:

- assess the children's present level of understanding and their strengths and weaknesses;

- design activities and learning tasks that give the learners the opportunity to communicate with each other, to argue and debate issues.

In this framework, teaching is regarded as the work of presenting learners with interesting learning materials, evocative learning situations, and learning tasks that allow them to discover new knowledge for themselves. The teacher's role during the learning process is that of guiding and managing the learning process (Gultig, 2001).

If a child is to keep alive his inborn sense of wonder without any such gift from the fairies, he needs the companionship of at least one adult, who can share it, rediscovering with him the joy, excitement and mystery of the world we live in (Carson, cited in Halonen & Santrock, 1996:315).

In the eight mathematics lessons observed, Mrs Mkhize tried to involve the learners in the activities that were done in class. Most of the work that the learners were presented with required them to discover the information on their own. The educator tried to let them to be independent, though in some instances, she was tempted to provide them with correct solutions. Most learners benefited from group work. Group work made it possible for the learners to get assistance from their classmates. Kyriacou (1997) states that one particularly healthy development in schools over the years has been the greater use of small group work. Small group work consists of academic tasks and activities undertaken by a group of pupils, which involve some degree of discussion, reflection and

collaboration. Advocates of the value of small group work have stressed the importance of the skills developed by the processes involved in this form of work (e.g. social and communication skills) as being educationally as important as – if not more important than – than the intellectual quality of the work produced. The aims may often be process rather than product oriented in emphasis. The importance of the collaboration involved in such work has received particular attention, and this is often referred to as ‘collaborative learning’. The point is frequently made that effective small group work must involve genuine collaboration, not simply pupils working alongside each other relatively independently and occasionally sharing answers.

Whitaker (1995) cited in Kyriacou (1997) has described the value of small group work thus:

- It creates a climate in which pupils can work with a sense of security and self-confidence.
- It facilitates the growth of understanding by offering the optimum opportunity for pupils to talk reflectively with each other.
- It promotes a spirit of co-operation and mutual respect.

In contrast, traditional teaching is characterized as involving more whole class teaching, pupils being seated at individual desks in rows, the use of expository teaching, and greater teacher control and direction over classroom activities.



The learners in Mrs Mkhize's classroom were seated in groups, and were involved in group work most of the time. It was on rare occasions that the learners were asked to work on their own. It becomes evident that the educator had tried to move away from the traditional teaching strategies. The learners' desks were not arranged in rows. However group sizes were large. Since the learners had to work in groups, they were able to assist one another because, as stated earlier, in most lessons they had to discover the information on their own. According to Eshel and Kohavi (2003) students' SRL strategies and their sense of self-efficacy will be highest when they perceive their classroom environment mainly in terms of a learner control style. Learners will tend to avoid self-regulatory strategies when teachers refrain from sharing classroom decision-making with them. In the mathematics lessons that were observed, the learners were in great control of the classroom activities. They were even allowed to write their solutions on the board. They were also encouraged to mark their own work.

The following poem was published on a poster, which hangs on the walls of a good number of senior officials of the national and provincial education departments in South Africa (Gulting, 2001).

*You taught me the names of the cities in the world
but I don't know how to survive the streets in my own city;
You taught me the minerals that are in earth
but I do not know what to do to prevent my world's destruction;
You taught me all about reproduction in rats*



but I don't know how to prevent pregnancy;

You taught me how to solve maths problems

but I still can't solve my own problems...

Why do I feel I have to leave school

To learn about coping with life?

(Author unknown)

When reflecting upon what took place in Mrs Mkhize's mathematics classroom, one can get the impression that she is trying to produce learners who will become independent and will be able to use mathematics intelligently to solve real life problems.

According to Paris and Winograd (2001) understanding the notion of self-regulation is important for teachers because teaching requires problem solving and invention. Teachers face problems and challenges that are complex and rarely straightforward. Understanding the notion of SRL enhances a teachers' ability to be reflective because SRL provides additional insights into the issues of teaching and learning, particularly those that arise when teachers are faced with the challenge of connecting their teaching and the students' learning to the real world. Knowing more about their own thinking, developing effective strategies, and sustaining their own motivation will be crucial for teachers interested in making schooling more relevant to the outside world.

In addition, by combining the notions of contextual teaching and SRL, teachers gain a deeper understanding of the learning experiences that face their students. Teachers have a

better sense of what is entailed in those experiences, what obstacles need to be overcome, and what teaching or learning strategies will be called into play.

The more the teachers understand about their own thinking, the better they can model this to their learners. Understanding self-regulation can help teachers make thinking public and visible. Thinking – strategic, independent, and inquisitive – then becomes a topic of classroom discussion, and an explicit goal of education. Understanding the nature of self-regulation and how it is nurtured opens up a world of possible roles and relationships between teachers and students. That is why metaphors of teaching such as coaching and mentoring are popular today, they emphasize how teachers design and scaffold experiences that lead students to emulate the wisdom of teachers (Paris & Winograd, 2001).

Teacher preparation programs must become a higher priority for universities in general and college of education in particular. There are models of teacher preparation programs that provide new teachers with rich curriculum and powerful mentoring relationships but these are labour-intensive. Using these models to prepare a larger proportion of new teachers will require universities and colleges to rethink their priorities.

Courses on pedagogy with information that focus on teaching and learning strategies that produce SRL for both teacher and learners need to be designed and taught.

Teachers need to do a better job of communicating with the public, policy-makers, and other stakeholders about the nature of teaching and learning (Paris & Winograd, 2001).

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