THE USE OF GROUP WORK IN THE TEACHING OF GRADE 9 MATHEMATICS

BY

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DECLARATION

I, Salamina Mathepa declare herewith that the mini-dissertation entitled, **The Use of Group Work in the Teaching of Grade 9 Mathematics** which I herewith submit to the **North-West University (Mafikeng-Campus)** as completion of the requirements set for the **M. ED. Degree (Mathematics Education)**, is my own work and has not already been submitted to this or any other university and that all material contained herein has been acknowledged.

SALAMINA MATHEPA

ACCEPTANCE OF DISSERTATION FOR EXAMINATION

The Mini-dissertation: **The Use of Group Work in the Teaching of Grade 9 Mathematics,** written by **SALAMINA MATHEPA, Student Number 12022993** in the School of Post-Graduate Studies, Faculty of Education, is hereby recommended for acceptance for examination.

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ABSTRACT

This study investigated the use of group work in the teaching of Grade 9 Mathematics in Botshabelo Cluster. The learners' involvement in learning in groups, time management of educators for activities done by learners, and group management were also examined. The subject of the study included 10% of Grade 9 learners in each Senior Phase School in Botshabelo Cluster in Mafikeng APO, North-West Province.

A total of 80 Grade 9 learners and a total of 7 Grade 9 Mathematics educators participated in the study. A survey method was used in this study. The questionnaires for learners and educators, class observation and interview for educators were administered to investigate the use of group work in the teaching of Grade 9 Mathematics.

A four-point scale:- strongly disagree/disagree/ agree/strongly agree was used in section B for both educators and learners, and a five-point scale:- not at all (1)/ very little (2)/ a little (3)/ a lot (4)/ a very great deal (5) for class observation of educators was used for the choice of both educators and learners on the use of group work.

From the research analysis, it was found out that group work could be used in the teaching of Mathematics even though the educators encountered problems in using it. Educators understand the usefulness of group work in teaching Mathematics. Although group work cannot be used all the time the educators affirm the importance of group work. Some learners also agree that group work is better than other learning strategies because it improves their learning and understanding of Mathematics concepts. Group work is used to help develop learners to be responsible and accountable, as well as to be able to manage their time effectively. Group work is a strategy that has been identified to increase learning achievement and participation in activities. Learners are grouped towards achieving a common goal for an activity and this motivates learners to be responsible for their tasks.

TABLE OF CONTENTS

PAGES

LIST OF TABLES

PAGES

CHAPTER ONE

ORIENTATION

1.1. Introduction and Background to the study

The South African education system has undergone a paradigm shift from the apartheid education system to Outcomes Based Education (OBE). Magadla, Shongwe and Taylor (2001:3) say that the curriculum is at the heart of the Education and Training system. In the past the curriculum perpetuated race, class, gender and ethnic divisions and emphasised separateness rather than common citizenship and nationhood. Therefore, it was imperative that the curriculum be restructured to reflect the values and principles of the new democratic society.

OBE was adopted in our education system because it sets clear outcomes for learners at each stage of their education. OBE takes a broader view of a learner's development than the apartheid system did. OBE promotes the development of skills, attitudes and values. The learners can play a much more active role in their own education than before. The approach can help to remove the discrimination of apartheid while preparing learners to function better when they leave school.

Curriculum 2005 was the new education curriculum that was driving the process of education transformation (Magadla, et al 2001: 6). Curriculum 2005 was introduced to try to correct the previous inadequate educational and training opportunities for learners. Curriculum 2005 involved structural and organisational changes in education. Bopape, Taylor and Mogashoa (2005:6) pointed out that the Revised National Curriculum Statement (RNCS) streamlined and strengthened Curriculum 2005 and continued to be committed to Outcomes Based Education. It was part of the process of transforming education and training to realise the aims of our democratic society and of the constitution. It is recommended that the critical outcomes should be maintained but the remaining seven design features should be phased out. The critical and developmental outcomes should be used as a starting point to develop RNCS. This change required educators to change their mindsets about how they used to teach Mathematics and to teach learners according to the dictates of OBE and C2005. This paradigm shift needs considerable time, extensive researches and the opportunity for Mathematics educators to

collaborate with each other to share methodology, especially work experience in dealing with groups. Mathematics educators need to read and be acquainted with group work in teaching as a strategy to understand group work dynamics.

Reynolds (1994: 20) says that many educators are realizing that there are instructional techniques other than the lecture, seminar and workbook. Wide-scale changes in the delivery of learning are starting to take place which some of the more enlightened educators have been advocating for many years. The use of group work can help to deliver learning in this changing time; it can shift the emphasis from the educator as custodian of knowledge to educator as manager and facilitator of learning. Reynolds (1994: 35) believes that learning in group work produces behaviour which is stimulating, not only socially but also intellectually.

In the traditional educational system, group work was mostly not considered or used. The reason for not using group work as a teaching strategy in classrooms and in learning activities by educators was because of lack of knowledge about this strategy as well as how to implement it, especially in overcrowded classes in traditional schools (Kramer, 1999: 3). The main difference between OBE and the traditional education system in our schools is how teaching strategies have been used. There were no variations of teaching strategies in the traditional system of education. In Department of Education (2004: 2) Mseleku says that in OBE, learners are active, teaching is learner-centred, the educator facilitates the learning process, the educator constantly uses group work and teamwork to consolidate the new approach and learning programmes are seen as a guide that allows the educators to be innovative and creative in designing programmes.

Many learners have problems in social relationships at school because of race, sex, personality, family background and other factors which can also lead to learning difficulties. Group work as a learning and teaching strategy, helps to reduce these learning difficulties (Reynolds, 1994: 24). Cowie, Smith, Boulton and Laver (1994: 52) say that group work helps educators to develop groups in their classrooms as an effective means of averting trouble and inducing a genuinely better attitude to collaboration with fellow learners. Group work can enhance relationships in the classroom to reduce prejudice and alleviate problems of victimisation and peer rejection.

Hanley (1994:1) says that traditional education emphasized the learning of answers more than the exploration of questions, memory at the expense of critical thought, bits and pieces of information instead of understanding in context, recitation over argument, and reading instead of doing. Educators did not encourage learners to work together, to share ideas and information freely, while in OBE, educators prepare learners to apply what they learn in school to the various and unpredictable situations that they might encounter in their daily lives as well as constructing new information according to their existing knowledge. The skills learned in OBE allow teachers to control group work. Learners are encouraged to work in pairs and small groups.

The focus of the research was on the use of group work in teaching Mathematics. The research investigated the challenges that the educators encounter in using group work as a teaching strategy and how it affects the level of understanding of Mathematics concepts. Group work as a teaching strategy helps to identify ways that can be used to develop social skills or problem-solving abilities and more broadly, to help the learners to understand the ways they relate in their groups.

1.2. Statement of the problem

Educators are faced with the problems of group formation, relationships between learners, learners' level of understanding in groups, the size of the classroom against the number of learners in a classroom, teacher-learner ratio as well as conflict management. Group work plays a major role towards the achievement of learners' outcomes from the collective contribution of both learners and educators.

The research was done under the following two influences. Firstly, there are few qualified Mathematics educators which leads to under-performance of learners in Mathematics as these educators are not well informed and trained about the teaching strategies which they must use to teach Mathematical concepts. This is because each and every topic has to be taught using the relevant teaching strategy. The teaching strategy does not answer the needs of the outcomes and assessment standards, for example, when teaching Geometry, one cannot exclude hands-on work by learners, they must draw structures and shapes and one cannot also avoid using group work because the learners need to compare their work with that of other learners.

The other influence of this study was the lack of interest of learners to study Mathematics as most of them regard it as a difficult subject because of the way it is being taught and learners were discouraged from studying it. This problem forced the government to make a policy introducing compulsory Mathematics for all learners. Lack of learner participation in learning Mathematics results in poor performance, because of the strategies that are used in teaching Mathematical concepts. The variation of teaching strategies is encouraged so as to allow learners to participate in learning as well as working co-operatively with other learners in their activities as they learn in groups, which will remedy the boredom and frustration some learners experience when learning Mathematics. Thus, the study investigated how the educators use group work as a strategy in the teaching of Mathematics.

1.3. Purpose of the study

The purpose of the study was to investigate the use of group work in the teaching of Grade 9 Mathematics in Senior Phase Schools of Botshabelo Cluster in Mafikeng Area Project Office (APO) in the North West Province. The role that group work can play in co-operative learning is that it allows understanding through active interplay of different perspectives from members of the involved group (Cowie et al, 1994: 43). The study also investigated challenges faced by educators and ways of improving the use of group work as a teaching strategy.

1.4. Research questions

The study was guided by the following questions:

1.4.1. Do Mathematics educators use group work in the teaching of Grade 9 learners?

1.4.2. What problems and challenges do Grade 9 Mathematics educators face in the implementation of group work?

1.4.3. What measures can be used to improve the use of group work in teaching Mathematics in Grade 9?

1.5. Significance of the study

This study reveals how group work is used in the teaching of Mathematics in schools. The study gives an understanding of the extent to which educators are concerned about the application of group work to daily life activities and to help in solving problems associated with teaching and learning Mathematics. It might also help Mathematics educators to form Mathematics clubs or societies at different levels such as local schools in one area, or clusters, as well as affiliating to the Mathematics organisation called AMESA.

The research will contribute to the improvement of learner performance as it will motivate educators to vary their teaching methods as well as identifying relevant teaching strategies which are relevant to the Mathematical concepts of the topic to be dealt with. The use of any teaching strategy without checking the Mathematical concepts for that strategy has also resulted in under performance of learners and non-interaction of learners in their learning process. The other significance for the study is for the educators to form Mathematics clubs where they will share their problems and frustrations about the use of group work in the teaching of Mathematics as well as the challenges they are facing in implementing this teaching strategy.

However, group work encourages meaningful learning and promotes the culture of learning. Group work may influence the educators' approach in teaching Mathematics. Group work also engages learners more in classroom activities, develops learners' communication skills as well as encouraging learners to construct their own learning abilities based on the Mathematical concepts.

1.6. Limitations to the study

The research was limited by the following factors:

My inexperience to conduct interviews as well as class observation especially on structuring questions for this two research instruments hindered my progress in my study. Most of the educators surveyed complained that the research questions were wasting their time when they were supposed to teach; learners might have not understood well when I explained to them how

to respond to the questionnaire which resulted in some learners leaving open spaces in the questionnaires and other learners were not co-operative in responding to the questionnaires. The sample used is just 10% from each school and it might not give the true reflection of the actual information, as it is not representing 50% of the population of learners in the school used in the study. The samples were only selected and gathered to generalise the information on the use of group work in the teaching of Mathematics Grade 9 learners in the Botshabelo Cluster.

1.7. Definition of terms

- **Group work:** It is a variety of activities where learners are encouraged to work in groups with the intention of developing aspects such as positive interdependence and individual accountability (Fraser, Loubser and Van Rooy, 1993: 52).

  Jacobs, Vakalisa and Gawe (2004: 209) further define group work as a way of teaching in which learners work together to ensure that all members in their groups have learnt and understood the same content and also as a type of activity in which learners work together in groups of two, three, four or more to do problem solving or other types of exercises in order to learn something.

- **Senior Phase school:** It is the third phase of school of the General Education and Training Band referring to Grades 7, 8 and 9 (Department of Education, 2002: 102).

- **Curriculum 2005 (C2005):** It is the first version of the post-apartheid National Curriculum Statement which gives a framework for Early Childhood Development, General Education and Training, Further Education Training and Adult Basic Education and Training (Department of Education, 2002: 101).

- **Outcomes-Based Education (OBE):** This is a process and achievement-oriented, activity-based and learner centred education process in which Curriculum 2005 and the Revised National Curriculum Statement Grade R-9 (Schools) aim at encouraging lifelong learning (Department of Education, 2002: 102).

- **Revised National Curriculum Statement (RNCS)** is the streamlined version of the South African School Curriculum that will be used from Grade R through to Grade 9, which strengthened Curriculum 2005 (Department of Education, 2004:3).

- **National Curriculum Statement (NCS)** provides a guideline of requirements and expectations at different levels and grades in the School Curriculum from Grade R-9 and consists of an overview of eight learning area statements and a qualification framework and aims at producing learners who are confident and independent (Department of Education, 2004: 5).

1.8. Organisation of the Dissertation

Chapter One: Orientation

This chapter presents the introduction and the background to the study, the statement of the problem, the purpose of the study, the research questions, the significance, the limitations of the study as well as the definitions of the terms used in the research.

Chapter Two: Literature Review

This chapter concentrates on discussions of the literature both international and national, on group work in Mathematics as well as the theory underpinning the study. The chapter also presents the rationale for the introduction of group work as a strategy for teaching Mathematics, types of group work, key elements for successful co-operative learning, selecting and arranging groups, managing group differences, requirements for group work learning, advantages, importance and disadvantages of group work, problems encountered in group work as well as implications for educators on using group work as a strategy.

Chapter Three: Research Design and Methodology

Chapter Three focuses on the research design. It also outlines the research method, population, sample and sampling procedure, research instruments and administration procedures.

Chapter Four: Data Analysis and Interpretation

Chapter Four presents in detail the analysis and interpretation of data collected.

Chapter Five: Summary of Findings, Recommendations and Conclusion.

Summary of findings, recommendations and conclusion of the research are presented in this chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The chapter presents the theoretical background that supports the research, the rationale for the introduction of group work as a strategy for teaching Mathematics, types of group work, key elements for successful co-operative learning, selecting and arranging groups, managing group differences, requirements for group work learning, advantages, importance and disadvantages of group work, problems encountered in group work as well as implications for educators on using group work as a strategy. The literature review also outlines different perspectives about the use of group work.

2.2. Theoretical framework for the study

The theory that underpins the study is constructivism. Constructivism is a theory of the construction of all knowledge and its limits, where learners actively construct their own meaning and knowledge by interacting with their environment (Silver, 1985: 254). Constructivism is a learning philosophy founded on the premise that we reflect on our experiences, and construct our knowledge based on our own understanding of the world that we live in (Brooks and Brooks, 1998: 5: on line). Constructivism is the reason why learning becomes the process of making our mental modes to be adjusted so as to accommodate new experiences. In constructivism, learners need to construct their understanding of each mathematical concept so that the primary role of the educator is not to explain, lecture or even to attempt to transfer mathematical knowledge to learners, rather to create learning situations for learners that will foster their making the necessary mental construction themselves (Math Forum, 2003, 5: on line).

Math Forum (2003, 5: on line) stated that teaching Mathematics is a challenge in which the educator has to create an environment that engages the learners as well as supporting their own

explanations, evaluations, communication, and also the application of mathematical models which are required to make sense of these.

The following are the principles of constructivism, which are suggested by Brooks and Brooks (1998: 7: on line)

- Learning is a search for meaning. Therefore teaching should start with issues around which learners are actively trying to construct meaning.
- Meaning requires understanding whole and parts, and it must be understood in the context of the whole; this implies that the learning process should focus on primary concepts, not on isolated facts.
- Educators should understand mental models, which the learners use to perceive the world, and the assumptions they make to support those models, as this helps the educators to teach well and effectively.
- The aim of learning is for every individual to be able to construct his or her own learning, not for the right answers to be memorised.

With regard to the search for meaning, group work encourages learners to brainstorm in trying to construct meaningful word sentences. Group work is inclusive with regard to teaching as whole contexts. Through group work the educators are able to understand group dynamics, for example, IQ and cultural background. Group work enables the learner to contribute part of the lesson to the overall success of the team.

Constructivism is the underpinning theory for the OBE curriculum because it sets clear outcomes for learners at each stage of their education. It takes a broader view of learner's development. Learners can play a much more active role in their own education. It emphasises more how learners learn and helps to remove the discrimination of the past (Department of Education, 2004: 4).

Foot, Howe, Anderson, Tolmie and Warden, (1994: 241) also assert that constructivism only applies to a special kind of learning and that any learning that takes place is influenced by the learning knowledge that already existed in an individual. Learning may also involve extensive reconstruction in which case activity will be conscious. Moodley, Njisane and Presmeg (1992:

92) also agree that constructivism supports group work as it encourages dialogue amongst learners themselves and between learners and the educator. Therefore it is very important that group work in mathematics should be conducted based on the understanding of how learning under constructivism takes place. This is because group work within the context of Curriculum 2005 is closely linked to the process of teaching and learning.

Yager cited in Hanley (1994:5) supports constructivism by suggesting the following procedures for teachers in implementing a constructivist format:

- Accept and encourage learner initiation of ideas.
- Promote learner leadership, collaboration, location of information and taking actions as a result of the learning process.
- Use learner thinking, experiences and interests to drive lessons.
- Encourage the use of alternative sources for information both from written materials and experts.
- Seek out learner ideas before presenting educator ideas or before studying from textbooks or other sources.
- Encourage learners to challenge each other's conceptualisations and ideas.
- Encourage adequate time for reflection and analysis, respect and use all ideas that learners generate.
- Use local resources as original sources of information that can be used in problem resolution.
- Involve learners in seeking information that can be applied in solving real life problems.
- Extend learning beyond the class period, classroom and the school.

Group work has been used as a teaching and learning strategy and there has been considerable growth of interest in different forms of groups in Mathematics. Group work is different from the old traditional teaching method of rote learning that was mostly used by educators before the implementation of OBE.

However, the use of group work can be summarized as motivational and educational. There is a belief that learners will learn more easily in groups because they are more involved and they learn from each other (Reynolds, 1994: 325). Thus, if learning is essentially a social process, then using

group work for learning is more likely to be effective than if it is limited to more individualistic approaches (Reynolds, 1994: 345). Group work teaching is getting learners to talk and think. Social constructivists also assert that dialogue among learners helps them explore, clarify and internalise concepts that are difficult to learn (Reynolds, 1994: 317).

2.3. Rationale for the introduction of group work as a strategy for teaching Mathematics

Group work is one of the teaching strategies that can be used in teaching Mathematics. The use of group work by educators is essential in teaching mathematics. Putnam (1997: 17) and Cowie, et al (1994: 116) agree that group work helps learners to achieve better. It also makes learners work towards the same goals and criteria for success and gives learners equal opportunities to contribute in their groups. It also creates conditions leading to the achievement of positive outcomes by directly teaching learners structured methods of working with each other. Achievement and productivity are higher when learners cooperate than when they work individually.

Putnam (1997: 21) and Reynolds (1994:24-25) say that there are many reasons for using group work in teaching mathematics; namely, to improve inter-group relations, improve self-esteem, allow higher-level reasoning strategies and increased critical reasoning competencies, and give greater ability to view situations from others' perspectives. Putnam (1997:30) further affirms that group work is used to allow greater intrinsic motivation, allow more positive attitudes towards subject areas, learning and school, lessen disruption and increase on-task behaviour, increase attendance, increase pro-social behaviour, improve skills at resolving conflicts as well as giving greater collaborative skills and attitudes necessary for working with others.

Group work is a teaching method that is "user-friendly" to learners; it allows them to participate in a learning environment. Through group work interaction, learners are able to solve problems, which are difficult for their level of understanding. Since OBE allows educators to group learners according to their level of understanding, and also to give individual work for learners to work at their own pace, this creates an environment of cooperation by learners rather than competition. The Department of Education says that through group work, learners are able to apply skills they have

learned in various situations to solve problems in everyday life. This prepares learners to become good adaptive and lifelong learners (Department of Education, 1997: 5).

2.4. Types of group work

There are many types of group work that an educator can use to teach Mathematics. The following authors Van Ments (1983), Silverman, Wetty and Lyon (1992), Hopkins (1993), Cowie, Smith, Boulton and Laver (1994), Sutherland and Bonwell (1996), Putnam (1997), Ornstein and Lasley II (2000) and Dumas (2003) identified the following types of group work that can be used in teaching Mathematics:

- **Jigsaw**

According to Cowie et al (1994: 51), Sutherland et al (1996:79), Putnam (1997: 147) and Ornstein et al (2000:326), jigsaw is when the section of the activities to be learnt is divided into component parts prior to the learning experience. In jigsaw each learner base group is given a different section of the activity to be learned. The activity is discussed among base groups members until the members have mastered the activity and can share it with others. The learners learn about the entire task given from peers without having had to independently read all of the activities. The learner pairs from each base group separate in order to form new groups in which all sections of the activity are done. The educator may ask learners questions randomly to check for learning as well as their level of understanding on the concepts they have studied or discussed. (Cowie et al, 1994:51), (Sutherland et al, 1996:79), (Putnam, 1997: 147) and (Ornstein et al, 2000:326).

The Learning Outcome 1 in the RNCS, deals with Numbers, Operations and Relations. In order to confirm the achievement of this outcome, the learners must be able to recognise, classify and represent numbers and properties of numbers as well as using different calculation types involving numbers (Department of Education, 2004: 34). This will be achieved by dividing a class into 4 groups. The first group will look into definitions of concepts, second group use common fractions, third group decimals and fourth group percentages. The learners will then

rotate from one group to the other to familiarise themselves with the four activities before presentations are made by individual groups.

- **Numbered Heads together**

Cowie et al (1994:53) and Putnam (1997: 143) assert that numbered heads together is a learning strategy, which the educator uses to ensure that learners are involved in learning. It also promotes co-operative interaction among the learners. In achieving Learning Outcome 2, Patterns, Functions and Algebra, the learners will have to reflect the following results; to deal with patterns, equations and equivalent representations (Department of Education, 2004: 37). The members of the group will have the following functions; the leader, the scriber and reporter. The leader will facilitate collection of data, the scriber will record the data and one member will report or present the data collected. The other members of the group will investigate and extend Numeric and Geometric patterns looking for a relationship including patterns; after data collection the reporter will present group findings.

- **Co-op Co-op**

Cowie et al (1994:53) and Ornstein et al (2000:327) agree that co-op co-op is the type of learning strategy in which learners work together in groups. The groups investigate the topic given by the educator. They also plan their investigation process and prepare the report and presentation. In achieving Learning Outcome 3, the groups will investigate the Space and Shapes of Geometry; the learners must be able to identify objects and shapes, position as well as transformation of shapes (Department of Education, 2004: 41). The first group will design and use nets to make models of geometric solids. The second group will use a pair of compasses, ruler and protractor to accurately construct geometric figures for investigation and the other groups will define the following concepts; polyhedra, quadrilateral, trapezium, perpendicular sides and kites.

- **Team-Assisted individualisation**

In team-assisted individualisation, the learners learn in a structured individualised programme by self-instruction with help from other groups. The educator intervenes only for a specific purpose. When learners reach the criterion for success they can move to another unit. If they fail to reach the criterion on their test they receive individualised attention from the educator. Learners participate on the pre-test of sequential knowledge and skills. They use the self-instruction worksheets and they work individually in groups (Putnam, 1997: 148) and (Ornstein et al, 2000:327). In achieving Learning Outcome 4, the educator will recognise individual capabilities by assigning individual group members different activities, for example, one will be given problems involving length, perimeter and area of polygons. The other members will describe and illustrate ways of measuring in different cultures throughout history, such activities will bring interaction amongst individuals and this will lead to substantial progress.

- **Pairs**

According to Putnam (1997: 143) and Ornstein et al (2000:327) pairs is a learning strategy in which learners are grouped in pairs so that they become engaged in learning, check each other's progress and consolidate their learning. In achieving Learning Outcome 4, the learning outcome focuses on time, units and instruments, perimeter, area and volume (Department of Education, 2003: 41). The educator will group learners in pairs to do the following activities; classifying angles into those greater than 180° and those less than 180°. The learners in pairs will assist and consolidate his/her partner in making progress in the given tasks.

- **Problem solving**

Putnam (1997: 190) argues that when people affiliate with one another for the purpose of accomplishing a goal, they can work together as a group in finding solutions. Foot et al (1994:424) also affirms that the manner in which help is requested and given provides information about what is taking place in the group but it may not completely explain students' behaviour and problems they encounter, or lead to increased understanding of academic content

and high achievement. Cangelosi (1997: 51) said that the results of the executions of processes, formulas and algorithms are interpreted to shed light on the original questions. The educator clarifies the questions posed by the problem, often in terms of more specific questions about quantities. The educator also makes a value judgement regarding the original questions.

- **Case study**

Case study is an in-depth analysis of real or simulated problems for learners to identify principles or suggest solutions. It is an active process that requires the learners to understand and apply theory rather than receive it passively; it prepares learners for the real world outside of school. Case study encourages learner-generated analysis rather than educator-manufactured solutions. In case study, learners must be prepared to assume responsibility for dealing with their problems rather than seek external causes beyond their control, learn to understand, analyse situations and to build and evaluate action plans. Silverman, et al (1992: 23), Hopkins (1993: 43) and Cowie et al (1994:164) say that case study is a formal analysis of an aspect of classroom life. It helps in plotting the progress of a learning area or learner's or group's reaction to teaching methods.

- **Role play**

Cowie et al (1994:53), Reynolds (1994:19) and Ornstein et al (2000:330) say that role-play involves learners in taking roles and acting them out. Role-play aims at making learners gain insight into familiar roles in different situations. Role play also help learners to develop the skills and understanding they need in their work as well as understanding more of another learner's situation. Van Ments (1983: 201) also emphasises that role-play is an excellent way of developing interpersonal and communication skills and provides a highly motivating and memorable lesson. Role play is best used in teaching where the educator wants learners to experience and become involved in the situation they are studying and to formulate their attitudes towards role play.

Van Ments (1983:183) further identifies the following advantages of a role-play; that it enables learners to express hidden feelings, enables learners to discuss private issues and problems, enables learners to empathize with others and understand their motivations, gives practice in various types

of behaviour, portrays generalized social problems and dynamics of group interaction, formal and informal. Van Ments (1983:183) further asserts that role-play gives life and immediacy to academic descriptive materials, provides opportunity for non-articulate learners and emphasizes importance of non-verbal emotional responses, becomes motivational and effective because it involves activity, closes gaps between training and real life situations, provides rapid feedback for both learners and educators, is learner-centred and addresses itself to the needs and concerns of the educator, changes attitudes of learners and permits training in the control of feelings and emotions and the group can control content and pace.

2.5. Key elements for successful co-operative learning

Dumas (2003), Sutherland et al (1996), Cangelosi (1997) and Putnam (1997) say that for group work to be successful, there are key elements that need to be followed: positive interdependence, individual accountability, face-to-face interaction, interpersonal skills and group reflection.

- **Positive interdependence**

Learners become positively interdependent when they realise that they have to achieve their goals. The sense of interconnectedness can help learners transcend the gender, racial, cultural, linguistic and other differences they may sense among themselves, as well as learn to share resources, support and encourage one another for the success of group members (Dumas, 2003: 2), (Sutherland and Bonwell 1996:75) and (Putnam, 1997:11).

- **Individual accountability**

Dumas (2003: 3), Sutherland and Bonwell (1996:75) and Putnam (1997:11-12) assert that learners are developed to take individual responsibilities for the task given by the teacher and to be accountable for each and every action they do to contribute either to the achievement or the failure of their group. They compete amongst themselves in groups about their performance.

- **Face-to-face interaction**

Learners are involved in in-depth discussion activities, which help them to develop reasoning and decision-making skills as well as solving problems together in their groups. Learners are able to achieve group goals as well as individual goals (Dumas, 2003: 3), (Sutherland et al, 1996:76), (Cangelosi, 1997: 207) and (Putnam, 1997:17).

- **Interpersonal skills**

When the environment becomes more conducive for learning, learners become freer and better able to participate by using their knowledge and abilities for the better performance of the group. Learners are able to help one another in the group as well as resolving conflicts. Learners are also developed to learn valuable skills that will benefit them socially and vocationally (Dumas, 2003: 4), (Sutherland et al, 1996:76) and (Putnam, 1997: 33-34).

- **Group reflection**

Group members are focussing on their general performance. Learners in a group use introspection to find out how co-operatively they are learning as well as to find out the strengths and weaknesses of their groups and to identify ways they can use to develop as a group as well as solving problems in their groups (Sutherland et al, 1996:76), (Cangelosi, 1997:211) and (Putnam, 1997: 17).

2.6. Selecting and arranging groups

The positive impact of group work in the social and cognitive relationship of the learners in the classroom was identified by Van DeVenter (n.d.), Cowie et al (1994), Ornstein et al (2000) and Petty (2004).

- **Selection by learners**

In this process learners feel more committed, responsible and willing to work together, but on the other hand it exposes learners who are isolated, introverted and reserved as they will have a problem in choosing the group where he or she wants to belong as well as other learners not choosing them (Van DeVenter, n.d.: 3), (Ornstein et al, 2000:303) and (Petty, 2004: 231).

- **Selection by educators**

The educator classifies learners according to their ability, that is, the slow, average and the fast learners, which will help the educator to structure the activities, according to the grouping, but it can limit the slower and average learners who do not have the opportunity to learn from the fast learners. The educator can also mix the learners according to their skills, which will complement the learning in the group. The skills grouping of learners helps the educator to work on weaknesses and build on strengths, such as listening, planning and reporting-back (Van DeVenter, n.d.: 3) and (Ornstein et al, 2000:311).

- **Random mixed groups**

Learners help each other and learn to deal with their differences. Mixing of learners can be in ability, gender, interest, background, language or personalities. It is stated that mixed groups are the most effective grouping for the purpose of co-operative learning (Van DeVenter, n.d.: 4), (Ornstein et al, 2000:312) and (Petty, 2004:231).

- **Naming groups**

Naming groups is very important to learners, so the educator must be very careful not to use names that are teasing, cause ridicule or stereotyped perceptions as they might cause problems and conflicts amongst the learners (Van DeVenter, n.d.: 4), (Cowie et al, 1994: 47) and (Petty, 2004:230).

- **Giving instructions to groups**

The educator must not give instructions to learners when they are not seated in their groups as some learners might be confused by the instruction, while others are not listening. It is better to group learners and give them instructions for the activity they are currently doing rather than giving the instructions of the whole activities as some might forget, get lost or become confused by the information. It is also good for the educator to ask learners to repeat the instruction given by the educator in order to check if they have understood the instruction well (Van DeVenter, n.d.: 5) and (Ornstein et al, 2000:354).

- **Moving between groups**

It is very important that when groups are busy with their activity, the educator should move around them so as to be able to talk to learners, assess progress, check that groups are functioning well together, see if the instructions given are followed correctly, gauge how well learners are coping with the activity, establish when learners are struggling with concepts and even to intervene when and where necessary. After the educator has found out that learners are comfortable in their groups with the activity, he can help learners to be more efficient by guiding them in sharing out work better and meeting deadlines, assisting the weaker members, praising others and encouraging one another, questioning one another, asking them to elaborate or justify their ideas. The educator can also help learners to give reasons for possible actions, think aloud in an open-minded way, and refocus attention on the task by summarising, and to refer back to the original criteria to check that they have met the requirements (Van DeVenter, n.d.: 5), (Ornstein et al, 2000;356) and (Petty, 2004:232).

- **Working with one group at a time**

As groups are sometimes grouped according to their abilities, there are times where the educator must have time to attend to that group which encounters more problems and give it more time than others. The other groups might disturb, but it is important for the educator to make sure that these other groups have clear instruction so that they must be busy on their task to avoid disturbance

when he or she attends to that group which has problems (Van DeVenter, n.d.: 6) and (Petty, 2004:231).

- **Social skills and group interaction**

For group work to be successful, the educator must teach the learners to work together as this will help learners to be able to complete their tasks effectively and successfully. If learners are not working co-operatively together, the group atmosphere might not be pleasant. The educator must help learners to develop skills so that they work well together and remain friends. The educator must teach learners the skills for listening, taking turns, checking for understanding, tolerance, accepting criticism gracefully and to be polite, respectful and caring (Van DeVenter, n.d.: 6) and (Ornstein et al, 2000:354).

2.7. Managing group differences

In OBE the educator is regarded as the facilitator and the manager of the activities he or she gives to the learners. He also guides the learners in their group activities. Thus the educator must be able to manage the differences among the groups in his or her classroom. The educator must be able to help learners to develop cooperative skills. Silverman, Wetty and Lyon (1992) and Putnam (1997) identified the following skills:

- **Interpersonal communication skills**

The educator must train learners to be active listeners, provide descriptive feedback, encourage learners to contribute their ideas, paraphrase and summarize as well as to criticize constructively (Silverman et al, 1992:89) and (Putnam, 1997: 72).

- **Group management skills**

According to Silverman et al (1992:89) and Putnam (1997: 72) the educator must encourage equal participation, train learner's time management skills, teach learners to stay on the topic and teach learners group observation and feedback skills.

- **Conflict management skills**

Silverman et al (1992:90) and Putnam (1997:72) agree that learners are active listeners; they synthesize diverse perspectives and confirm other learners' personal competences.

- **Leadership skills**

The educators need to provide direction to the group, to keep group members on task, to acquire needed resources for the group and to plan work management (Putnam, 1997: 72). The educator must make sure that he or she gives the learners the security that they belong to, or have a key place in the group or classroom, that learners experience a sense of importance or power, of being listened to, they need to experience freedom by being able to make choices in some aspects of the daily school curriculum and need to have fun (Silverman et al, 1992:90) and (Putnam, 1997: 73).

Silverman et al (1992:91) and Putnam (1997: 73) further affirm that the educator must develop clear rules for the class so as to avoid conflicts among the groups in a classroom. The following are some of the rules, which can be used. The educator must make sure that learners listen carefully to each other, give everyone a chance to participate, be respectful by making positive comments and avoid put-downs as well as getting everyone's opinion before making decisions.

2.8. Requirements for group work learning

Fraser, Loubser and Van Rooy (1993: 52) argue that group work should be viewed as a specific teaching strategy aiming at creating co-operative learning experience and rule making. However, Slabbert (1992, 439) cited in Fraser et al (1993: 52) identified the following requirements of group

work learning, that is, co-operative skills, individual accountability, evaluation, face-to-face interaction, group size and positive interdependence. Lemlech (1988:33) further asserts that groups need to accept a system of rules that govern members' behaviour, develop procedures, articulate their objectives and communicate their problems.

2.9. Advantages and the importance of group work

According to Kramer (1999:95), group work forms an important part of teaching and learning because it is authentic, it allows learners the opportunity to recognize and practice the skills needed to work with others in an organized way, it provides opportunities for learners to develop attributes such as independence, self-discipline, self-confidence, self-reliance and handling of conflict situations.

Furthermore, Kramer (1999:98) says that it is important to understand that learners do not necessarily have the skills to participate effectively in group work. These skills need to be taught and practised. Kramer (1999:98) further affirms that skills are needed in order for effective group work to be achieved. The skills that are needed are to select a group leader, facilitator or chair, to assign specific tasks to the members of a group, to be accountable and responsible to the group, to share workloads and help each other, to involve weaker or quieter group members, to cope with conflict in the group, to develop listening, speaking and other communication skills, to build consensus in the group, to develop time management skills and to learn appropriate meeting procedures, that is, taking notes and decision making.

Barry and Kine (1998: 214) assert that the major purpose of group work is to foster communication skills within the class. The learning strategy will help to promote thinking and decision-making skills as well as fostering different view points and opinions. Dumas (2003: 3) also asserts that a cooperative learning technique that reduces racial conflict among school learners promotes better learning, improves learners' motivation and increases enjoyment of the learning experience.

Fraser et al (1993: 85) assert the advantage of group work is that learners are given the opportunity to work with other learners and realise that people do differ in opinions. Learners are given an opportunity to consult each other to make joint decisions and conclusions as well as becoming responsible. They develop the ability and skills to communicate. Caprio (1994: 256) says that group work helps learners to share ideas, discuss the problems at hand and agree on a common solution. The educator provides help and guidance when necessary. Group work engages learners in helping, assisting, supporting and encouraging each other's effort.

Cangelosi (1992: 238) says that group work helps learners to develop cognitive and affective outcomes. In group work, learners also strive to learn the subject matter because they discuss and argue on how to get solutions to the given task. This helps learners to develop a wide range of skills such as listening, communication and reporting. Learners also learn to share ideas and to respect other's viewpoints. Learners gain leadership skills; as learners express themselves, this helps them to develop their self-esteem.

Cangelosi (1992: 240) further says that in groups, all learners are expected to take part; even the shy ones are afforded the opportunity to contribute. Those who lack motivation may also improve because they are involved in the activity and this helps them develop a sense of belonging. As learners listen critically, accurately evaluate the validity and reliability of words and arguments, they also become creative and critical thinkers. This teaches them that there are many ways of solving a problem. Group work encourages positive interaction among the learners and it allows learners to express their opinions. Group work promotes an atmosphere for growth, promotes confidence and it also creates different learning tasks for different groups. Group work allows learners to work at their own pace, brings validity into learners' attitudes and it allows learners' participation in class. In group work the lesson becomes learner-orientated and the educator's role is that of facilitation.

The purpose of group work is to develop the skills necessary in working with others in problem solving and planning. Group work also helps the educator to gain an understanding of the difficulties which the learners can encounter, as well as helping learners develop self-confidence

through expressing and defending an individual's own ideas (Lemlech, 1988: 59) and (Cowie et al, 1994: 192).

2.10. Disadvantages of group work

Group work might demoralise learners who are introverted and the educator is not recognising their passiveness in the group, while the educator concentrates only on the talkative, extrovert, active learner or the group leader. Group work might not allow the educator to understand the learners' problems as the educator mostly concentrates on groups instead of giving learners individual attention. Group arrangement might also cause problems if not done properly. Groups might not accomplish the intended objectives if the educator does not control the group when learners are discussing because some might just argue their own issues, which are outside the task given by the educator.

2.11. Problems encountered in group work

Jewett (1996:3), Sutherland et al (1996:85) and Cangelosi (1997:251) assert that even though group work plays a major role in teaching and learning there are some problems that occur when using group work. The problems that are encountered in group work as mentioned by Jewett (1996:3), Sutherland et al (1996:86) and Cangelosi (1997:251) were the dominating personalities, learners who do not listen, too much reliance on the practitioner, fighting or conflict, horsing around, non – participation and ridiculing or picking on. Jewett (1996:3) and Cangelosi (1997:251) outline the challenges that are encountered in using group work. Those problems are; initial passive and uncertain groups, questions and activities that are not clearly structured, learners who monopolise the conversation, disruptive and off-task behaviours. Jewett (1996:3) and Cangelosi (1997:251) further argue that lack of careful monitoring of groups and helping with the problem they are busy with cause disruption in classrooms.

2.12. Supporting literature for research questions

2.12.1. The use of group work

Cangelosi (1997: 207) said that educators use group work in teaching Mathematics because other learners learn better from their fellow learners. A variety of task group pattern is commonly used to facilitate cooperative learning in which one learner teaches others or provides help with a particular section. Jacobs, Vakalisa and Gawe (2004: 18) also confirm that educators use group work as it encourages learners to assist their peers to obtain assistance, promotes the sharing of knowledge amongst learners and it encourages learners who are capable and willing to lead class discussions on aspects of contents which are appealing to them.

Jacobs et al (2004: 210) further says that the use of group work in teaching Mathematics shows that learners tend to master concepts better than their fellow learners who learn individually and they generally feel better about themselves and build-up their self-esteem and their confidence. If group work is used but it does not serve the purpose of allowing learner-centered activities, even though learners are sitting in groups, the educator finds it difficult to involve learners to do the tasks in groups, the educator dominates as other learners are also not willing to participate and they become passive (Vithal, Adler & Keitel, 2005: 33).

2.12.2. Problems and challenges encountered in group work

Cangelosi (1997: 189) said that educators encounter problems when using group work: one such problem is that learners are given tasks to work on, but instead they do their own thing, e.g.: Cangelosi (1997: 21-22) "After being told by their teacher to work out the task on their given work sheets, one learner "Jaylenene" begins to do the task while "Fred" begins drawing pictures of robots on the task sheet." The educators sometimes find group work very challenging especially when learners do not understand the problem to deal with; the learners consume much time in asking for clarity from the educator, and learners sometimes have tendency of directing their comments to the educator. The other problem is of learners or groups who finish early and wait for others to complete their task and cause disruptive behavior and disturbing the on-task groups. Group work in

large classes physically hinders the educator in moving around the class so as to monitor group progress in the given task (Jacobs, et al, 2004: 421).

2.12.3. Measures to be used to improve the use of group work

Cangelosi (1997: 129) said that educators need to make rules in their classrooms so as to avoid disruptions in group work activities as well as making incentives available, such as learners being applauded for their cooperation and effort as well as being motivated. The other measures that can be used to improve the use of group work are that the educators must give good guidance about the tasks given to learners and the instructions should be clear and simple (Cangelosi, 1997: 157).

When using group work in teaching Mathematics, educators must also avoid labelling learners, as this might hinder the learners' participation. This will result in the educator not achieving his or her goals. The educator must praise learners' work and their desirable behaviours, because being praised motivates desirable learner's behaviour and active participation.

The educators must create in their classrooms a businesslike environment in order to allow all learners to be attentively involved in their activities in their groups, in which the educator and learners are focusing on achieving their specific goal for that task. The educator must employ only learning activities with easy-to-follow, uncomplicated directions; for example, if students are confused by the initial directions of the task, they are less likely to bother trying to understand subsequent ones. Having all learners working on the same task allows the educator to keep directions simple, monitor the class as a whole and compare how different groups approach a common task (Cangelosi, 1997: 204).

2.13. Link of literature review with data analysis

Types of group work were outlined in order for the educators to be exposed to different forms of group work that they can use to teach Mathematics based on the educators' and learners' responses. Learners find group work very interesting in studying Mathematics and educators use group work to be able to achieve some goals in teaching Mathematics concepts or topic which cannot be

achieved through individual learning. Based on selection and arrangement of learners, the analysis reflects that learners are given an opportunity to form groups in which the roles are not rigid. This shows the education system which has changed from one-way interaction to two-way interaction which is supported by constructivism as well as OBE.

Managing group differences also contributes in the use of group work because the educator must be able to manage learners so that he/ she can reach the objectives or the outcomes of the lesson. This also helps the educator to solve conflicts and to intervene in groups and assist with time management. This is also confirmed by the educators' responses that they intervene in group conflicts in page 47 and that learners are able to finish their tasks on time which is the contribution of learner accountability and assertiveness skill which is developed through group work.

2.14. Conclusion

Group work is a strategy that has been identified to increase learning achievement and participation in activities. Learners are grouped towards achieving a common goal for an activity and motivating them to be responsible for their tasks. Group work also improves the learners' interpersonal relationships as well as enhancing one's self-esteem. The use of group work by the educators reduces the involvement of the educator as the main participant in the learning process rather than being a manager and facilitator. The educator will be able to manage group conflicts and help learners to develop teamwork skills and abilities. Group work will also help learners to learn to respect each other's opinion, supporting each other as well as helping them to develop leadership skills.

In the past, teachers primarily relied on teacher-directed, whole-class instruction with little instructional variability. Mostly, they lectured to their students and led class discussions with few educator-to-learner interactions (Putnam, 1997: 29). Replacing a classroom behaviour management that was authoritarian, the use of group work management encourages equal participation, trains learners' time management skills and teaches learners to stay on the topic. In an inclusive classroom, the selection and arrangement of groups will enable the educator to classify learners according to their ability, that is, the slow, average and the fast learners. The use

of group work in Mathematics allows learners to participate and to develop attributes such as self-reliance and handling conflict situations.

The next chapter outlines the research design and methodology on how the research was conducted.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This chapter outlines the research design and method of research used in the study. It also explains how the research was conducted, through population and sampling, research and administration procedures to ensure the validity of the study.

3.2. Research Design and Methods

This research combined both qualitative and quantitative approaches. Best and Kahn (2003:75-76) define quantitative research as a research which consists of the data that can be analysed in terms of numbers, and qualitative research is a research which describes events and persons scientifically without using numerical data.

Qualitative research techniques were used to analyse research data from the questionnaires which could not be expressed in numbers, which allowed the researcher to seek relationships between various factors that have been identified in the study and also generated detailed and valid data that contributes to an in-depth understanding of the context in which the phenomenon under study took place (Wiersma and Jurs, 2005:13).

Quantitative research techniques were used to analyse research data from structured questions. Quantitative research is objective as it is believed that it helps in gaining, analysing and interpreting quantitative data as well as allowing the researcher to remained detached. Quantitative research is deductive as it tests theory and produces results that can be generalised to new situations (Wiersma and Jurs, 2005:14).

The research method used in this study was survey. Cohen, Manion and Morrison (2000: 171) said that the use of survey in a research helps to gather data at a particular point in time with the aim of describing the nature of the existing conditions.

The research method used in this study was survey. Cohen, Manion and Morrison (2000: 171) said that the use of survey in a research helps to gather data at a particular point in time with the aim of describing the nature of the existing conditions.

Cohen et al (2000: 171) further identify the characteristics of a survey as a method which generates numerical data, helps to gather standardised data that can be processed statistically and to gather data on a one-shot basis. A survey is economical and efficient. Survey method also provides descriptive, inferential and explanatory information, supports hypotheses about target population and represents a bigger target population. Survey method is a method which makes generalisations. Observed patterns of response in the target focus rely mostly on bigger scale data gathered from a bigger population so as to enable generalisation to be made about given factors and also captures data from multiple choice, closed questions, test scores and observation schedules.

Oppenheim (1992; 12) says that the purposes of the survey research method are to make inferences about the whole population to be used as well as counting the representative samples. Its purpose is also to gather the information that would be used to identify the number of members of the population that have certain ideas. Brink (1996: 67) also agrees that the purpose of the survey helps to identify the present situations and the needs, and it also helps to uncover the data that would be analysed.

3.3. Population and Sampling

The population consisted of 806 learners all from the Senior Phase Grade 9 of Botshabelo Cluster. Botshabelo Cluster consists of four Senior Phase schools. namely, Reeme-Batloung, Gakologelwang, Malefo-Malea and Sebopiwa-Molema as listed in Table 1 in page 32. All four Senior Phase schools in the Cluster were used in the research. The table in page 32 indicates the distribution of sampled population.

Table 1: Distribution of the Sample Population

Name of school	Sample Population and Percentage		
	Educators for questionnaires, interview and observation	Learners for questionnaires	10% Sample
Reeme-Batloung	2	123	12
Gakologelwang	1	180	18
Malefo-Malea	1	214	21
Sebopiwa-Molema	3	289	29
TOTAL	7	806	80

All the Grade 9 Mathematics educators in the schools were used for the research. Gakologelwang Senior Phase school has one (1) Grade 9 Mathematics and 180 Grade 9 learners, Malefo-Malea Senior Phase school has one (1) Grade 9 Mathematics educator and 214 Grade 9 learners, Reeme-Batloung Senior Phase school has two (2) Grade 9 Mathematics educators and 123 Grade 9 learners and Sebopiwa-Molema Senior Phase has three (3) Grade 9 Mathematics educators and 289 Grade 9 learners. The total population of Grade 9 Mathematics educators were seven (7) for questionnaires, and class observation as well as for interview, and the total population of Grade 9 learners was 806.

The sampling technique that was used for the educators in the research was purposive sampling. The sampling for educators was purposive because the school in the Botshabelo Cluster are only four (4) and educators for grade 9 Mathematics are also few, so I decided to take all Senior Phase schools in Botshabelo Cluster to get the general feed-back about the use of group work in teaching Mathematics. Cohen et al (2000:239) defines purposive sampling as the procedure in which the researcher handpicks the cases to be included in his sample on the basis of his judgement of their typicality, builds up the sample that is satisfactory to his specific needs, because each member of the population had an equal chance of being selected and the sample contained subjects with characteristics similar to the population as a whole.

The selection of learners was random. The sampling for learners was random because the population of learners in each school was very high, so it was not possible to take all learners in each school. I decided to take 10% of the total number of learners in each school.

The sampling for learners was random because the population of learners in each school was very high, so it was not possible to take all learners in each school. I decided to take 10% of the total number of learners in each school. Cohen et al (2000:238) defines random sampling as a procedure in which each member of the population under study has an equal chance of being selected and involves selecting at random from a list of population required the number of subjects for the sample. All the grade 9 learners wrote their names on the papers and put them in a bowl and the papers were mixed, and the researcher picked only ten percent (10%) of the total number of the Grade 9 learners in each school that was used in the research as it was illustrated in Table 1 in page 32.

In Reeme-Batloung Senior Phase School the Grade 9 learners are 123 and 12 learners were used, in Sebopiwa-Molema Senior Phase School the Grade 9 learners are 289 and 29 learners were used, in Gakologelwang Senior Phase School the Grade 9 learners are 180 and 18 learners were used and in Malefo-Malea Senior Phase School the Grade 9 learners are 214 and 21 learners were used. The total sample of the learners that were used in the research was eighty (80) as shown in Table 1 page 32. I observed seven (7) classes from four (4) Senior Phase schools in Botshabelo Cluster as my sampling was purposive. In Reeme-Batloung Senior Phase there are two (2) classes, Sebopiwa-Molema Senior Phase there are three (3) classes, Malefo-Malea Senior Phase has one (1) class and Gakologelwang Senior Phase has one (1) class as reflected in Table 1 page 32. The schools were purposively chosen because Botshabelo Cluster has only four (4) Senior Phase schools and if the schools were 10 or more, I could have chosen them randomly. All grade 9 classes in the school were observed as they were not taught by one (1) educator especially in Reeme-Batloung and Sebopiwa-Molema, but with Gakologelwang and Malefo-Malea I observe one (1) class as all the grade 9 classes are taught by one (1) educator.

Both the questionnaires for learners and educators were piloted. The questionnaire for educators was piloted by three (3) educators and for learners it was piloted by only five (5) Grade 9 learners from the other Clusters that I am not using for the research. The responses that I received from this pilot sample were not different from the population sample used in the research. From the piloted sample of educators, they do agree that group work is essential as it enhances the learners performance which brings positive achievement, thus they use group work in the teaching of Mathematics. They further support the use of group work because it develops the learners to be accountable and responsible for their action and their learning activities and learners participate freely amongst themselves. Management and assertive skills are also developed through group work. Learners participate in forming and naming groups.

With the focus on the piloted sample of learners they too find group work very interesting as they work freely in their groups and it also enhances their performance and self-esteem even though their educators are mostly not using group work. They agreed that they are given responsibilities in their groups and they are able to account for all their action in their process of learning. Group work also helps learners to manage their time when given activities and develops their assertive skills.

3.4. Research instruments

Questionnaires were designed and used for Mathematics educators and the Grade 9 learners. In this research, the questionnaires were used to gather information on the use of group work in the teaching and learning of Grade 9 Mathematics in Senior Phase schools. A questionnaire is a widely useful instrument used for collection of surveyed information, providing structured and often numerical data (Wilson and McLean, 1994:219). Cohen et al (2000:247) regard a questionnaire as a widely used and useful instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher and often being comparatively straightforward to analyse.

3.4.1. Structure of the questionnaire

The questionnaires were divided into closed and open-ended questions.

- **Closed questions for the research**

Cohen et al (2000:248) say that closed questions are questions that prescribe the range of responses from which the respondents may choose. Oppenheim (1992:342) agrees that closed questions will offer the respondents a choice of alternatives and replies, where the respondents would be asked to tick or underline his or her answer(s).

- **Open-ended questions for the research**

Open-ended questions are free-response questions where the respondents are not restricted to any choice or have any choice or have any limits and they have to give their personal opinions on issues (Oppenheim, 1992:372). Open-ended questions were also used in this research because they enabled the respondents to write free responses in their own terms, to explain and qualify their responses as well as avoiding the limitations of pre-test categories of responses. The technique for the questionnaire was both quantitative and qualitative because the researcher interpreted, explained, predicted and analysed the data. (Cohen et al, 2000:248).

3.4.2. Interview

Cohen et al (2000: 267) define interview as a situation in which a conversation is initiated by the interviewer for the specific purpose of obtaining research's relevant information and in which the educators are focusing on the content specified by research objectives of systematic descriptions, predictions and explanation.

Structured interview was used in the study. Cohen et al (2000:270) defines structured interview as the type of an interview, which follows a fairly clear and well-maintained schedule or pre-organised plan. Cohen et al (2000:271) say that the main characteristics of structured interview remained with the interviewer at all stages, the procedure is determined beforehand, it eliminates the researcher subjective judgement, the interviewer retains control throughout the whole process and the interviewer directs the proceedings. Interview research data was collected by audio tape recording. An appointment was made to administer the interview. The researcher set 1 hour to

interview each educator at the specific venues. In this instrument, the research technique was qualitative because the researcher interpreted, explained, predicted and analysed the data (Cohen et al, 2000:248).

3.4.3. Observation

Cohen et al (2000:306) define observation as the act in which the researcher gathers "live" data from a situation. Cohen et al (2000:306) further say that observation helps the researcher to enter and understand the situation that is being described. Observation is a technique for descriptive data collection on behaviour, events and situations. Observation is important because certain behaviour needs to be observed with careful record keeping. All observation must be checked and controlled. In this study, structured observation was used to record advance preparation of record keeping forms, for example, checklists, categorisation systems and rating scales that were used by the researcher. Observation is mostly used in quantitative study (Brink, 1996:195). In observation, qualitative research was used because the researcher analysed the data from the observed session done in seven classes.

Seven classes were observed during the observation schedule. The researcher observed how the lesson was introduced using group work, how the lesson was presented and how to conclude the lesson. During the observation, the researcher used the grid to score the educators when they were teaching using group work.

3.4.4. Validity and Reliability

Wiersma and Jurs (2005:265) define validity as the best available approximation to the truth or the falsity of a given inference, proposition or conclusion. Kumar (1996: 137) defines validity as the ability of an instrument to measure what it is designed to measure or the degree to which the researcher has measured what he/she has set out to measure. Validity means a test should measure what it is supposed to measure. For the questionnaire to be valid, the researcher should concentrate on designing questions which test mathematical skills and concepts. The research is valid because all the research instruments measure what I intended to measure, for example, the questionnaire,

observation and interview questions, all are focusing on the use of group work by educators in teaching Mathematics, what problems and challenges they encounter when implementing group work and what measures are they suggesting to improve the use of group work. The researcher used valid instruments in order to minimise the threat to validity on questionnaires. The researcher ensured that the questionnaires were simple and straightforward. The research is reliable because the interviews were structured, the interviews have the same format and sequence of words and questions for each respondent.

According to Cohen et al (2000: 117) reliability is a synonym for consistency and repeatability of time, of instruments and of groups of respondents. Kumar (1996: 140) defines reliability as the degree of accuracy or precision in the measurements made by a research instrument. Reliability is the extent to which the same questions/ questionnaire/ test produces the same results, if it is administered to the same group of learners under similar conditions. The questionnaire is reliable if it produces the same results consistently, time after time. Reliability is affected by variability in the performance of learners which may be caused by their being tired or under stress.

The research is reliable because I used the same questionnaire for learners for all learners in four schools, and the same questionnaire for all educators in my population sample, as well as the interview questions to all the educators in my research. It is the same with the observation sessions; the procedures are the same in the manner that I made appointments to all educators and allowed them to give me their available time to interview them and to observe their teaching classes. The other reason that I think make the research reliable is the responses that I got from the educators in the interview and in the questionnaire as they affirm that they are using group work in teaching Mathematics.

The researcher used reliable instruments as the integration of both qualitative and quantitative methods makes the research findings and conclusion reliable.. The researcher gave equal time to the respondents as well as repeating the same questions to all the respondents. The participants had to choose in responding to the questionnaires whether they (SD) Strongly Disagree/(D) Disagree/ (A) Agree/ (SA) Strongly Agree with the statement.

The technique used in the research was triangulation. Triangulation is the use of two or more methods of data collection in the study of some aspect of human behaviour (Cohen et al, 2002: 112). It is a technique of physical measurement. There are different types of triangulation. In this research, the methodological triangulation was used. Methodological triangulation is the measure in which the researcher use more than one way of assessing and investigating a single problem looking for convergent evidence from different sources (Terre Blanche and Durreheim, 2004: 431). Triangulation is a process that is used in qualitative and quantitative research in order to gather information with different points of view or with different angles (Kumar, 1996: 143). Triangulation was done through questionnaire, observation and interview.

In the research, I used questionnaire, interview and observation to gather the information because I wanted to get more information about the use of group work in the teaching of Mathematics. With the interview, the interviewees are given enough time to respond to questions. The questionnaires have more closed questions than open-ended questions, where the respondents are allowed to say their opinion. I used the observation method because some of the educators may respond in questionnaires that they do use group work, not responding honestly and during observation you find that they are actually not even familiar with aspects of group work, they only focus on the teaching strategies that were used before the implementation of OBE and NCS. The data analysis of the questionnaires used tables and frequencies. In the interview the data that was used was interpretive while in observation sessions the data analysis that was used was rating or scoring.

In this study, the researcher used methodological triangulation because she used questionnaire, observation and interview to collect the data. Qualitative and quantitative research methods were used in order to explain and predict the results after collection of data and to describe, explore and build theory about data as well as making personal view about the results (Cohen et al, 2002: 113).

Interview in this research is valid. According to Cohen et al (2000: 121) it must not be biased, that is, the interviewer must not have a tendency of viewing the respondents in her own image. The other thing is that the researcher must not seek answers that support her pre-conceived notions. Interview is also reliable because the interview session was structured; the same format and

sequence of words and questions were asked for every interviewee (Cohen et al, 2000:121). Cohen et al (2000: 122) further said that the reliability of the interview is also emphasised by the fact that the researcher piloted the interview schedule which the researcher in this study has carefully done. The researcher sent the questions to the interviewees 4 weeks before she had the actual session of interview.

The questionnaires were valid and reliable because they are anonymous and encouraged honesty (Cohen et al, 2000:129). In this study, the questionnaire is reliable because the questionnaire did not have a space to write the respondent's name, so it was anonymous and it is more economical on time as it does not take more than 30 minutes for the respondents to respond to the questionnaire. Observation in this research was valid and reliable because the presence of the researcher observing might have changed the behaviour of the learners in the observed classes as well as that of the educators. The reason might be the educator had a pre-briefing with the learners about the observation session. The structured observation also makes the research reliable (Cohen et al, 2000: 130).

3.5. Administration procedures

The following steps guided the success of the research:

- A letter of request, which indicates the purpose of the research, was sent to the schools.
- Arrangements were made with Mathematics educators for the distribution of questionnaires to all the respondents in the school.
- Arrangements were made for the collection of completed questionnaires.
- Arrangements were made with Mathematics educators for interview.
- Arrangements were made with Mathematics educators for lesson observation.

The chapter that follows focuses on the steps that were followed in the analysis and interpretation of data.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION OF DATA

4.1. Introduction

This chapter reports on the results of the empirical investigation conducted to identify the Mathematics educators' and learners' responses on the use of group work in the teaching of Grade 9 Mathematics in the Senior Phase schools of Botshabelo Cluster in Mafikeng APO in North West Province. The data collected through the investigation is summarized and discussed below. Data analysis for both educators' and learners' questionnaires was quantitative and qualitative.

4.2. Review of the subjects

Of the total subjects (80), 100% of Grade 9 learners respondents and of the total subjects (7) 100% of Mathematics educators' respondents of questionnaires were returned. The data of the research were collected from the four sources namely, questionnaires from learners and educators, class observation and educators' interview. All educators and learners of the researched schools responded to the questionnaires and no school failed to return the questionnaires. Table 2 below shows the response rate of educators and learners.

Table 2: Response Rate

Name of School	N		Response	
	Educators	Learners	Educators	Learners
Reeme-Batloung	2	123	2	12
Gakologelwang	1	180	1	18
Malefo-Melea	1	214	1	21
Sebopiwa-Molema	3	289	3	29
TOTAL	**7**	**806**	**7**	**80**

4.3. Educators' and learners' responses to questionnaires

4.3.1. Educator's and Learners' responses to research question 1.4.1 (cf page 4)

Table 3 and Table 4 represent the educators' and learners' response about the rationale for the introduction of group work.

Table3: Rationale for group work introduction for Educators

1.Rationale for group work introduction	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
1.1.Group work essential					4	57.1	3	42.9				
1.2.Interest in group work					4	57.1	3	42.9				
1.3.Positive achievement					3	42.9	4	57.1				
1.4.Teach through group work					4	57.1	2	28.6			1	14.3
15.Always use group work			4	57.1	2	28.6	1	14.3				
1.6.Outcomes achieved in groups			1	14.3	5	71.4	1	14.3				
1.7.Group work enhances performance					5	71.4	2	28.6				

The data displayed in Table 3 reveals that most educators believe that group work is essential in teaching Mathematics. This is evidenced by the fact that all educators responded positively on this aspect. For instance it is reflected that 57.1% agree and 42.9% strongly agree. This is an indication that educators understand the usefulness of group work in teaching Mathematics.

Group work may not necessarily apply to some aspects of a learning area or subject. As a result educators may resort to some other strategies that will enhance effective teaching and learning. It is shown in Table 3 that educators indicate that they do not always use group work. This shows that although group work cannot be used all the time, the educators affirm the importance of group work in teaching Mathematics. Furthermore, the educators believe that group work improves the results

of learners' Mathematics performance as well as helping learners to achieve their outcomes in the activities they are given by their educators.

Table 4: Rationale for group work introduction for Learners

1.Rationale for group work introduction	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
1.1Free participation	8	10	8	10	38	47.5	26	32.5				
1.2.Interest in group work	6	7.5	14	17.5	38	47.5	22	27.5				
1.3.Improves performance	6	7.5	10	12.5	30	37.5	34	42.5				
1.4.Sit in groups	3	3.75	16	20	34	42.5	25	31.25			2	2.5
1.5.Group work activities	8	10	30	37.5	26	32.5	12	15	3	3.75	1	1.25
1.6.Learn in groups	21	26.25	40	50	12	15	4	5	2	2.5	1	1.25
1.7.Group work better than individual	18	22.5	19	23.75	21	26.25	20	25	1	1.25	1	1.25
1.8.Group work improves learning and understanding	6	7.5	11	13.75	29	36.25	31	38.75	3	3.75		

Table 4 reflects that learners do not consider group work better than other teaching strategies as it is confirmed by the response that 22.5% strongly disagree and 23.75% disagree, but learners believe that group work is interesting, as they sit in groups and they participate freely. Despite the fact that they find group work interesting, most of their activities are not done in groups and most of the time they do not learn in groups. Some learners agree that group work is better than other learning strategies and it improves their learning and understanding of Mathematics concepts.

However, this is supported by Putnam (1997: 17) and Cowie et al (1994: 116) that group work creates conditions leading to positive achievement outcomes by directly teaching learners structured methods of working with each other.

Despite the fact that some learners agreed and others disagreed about the rationale for the introduction of group work in their learning of Mathematics. Putnam (1997: 30) agrees that group work allows greater intrinsic motivation, allows more positive attitudes towards subject areas, learning and school, lessens disruption and increases on-task behaviour, and improves collaborative skills and attitudes necessary for working with others.

In addition, it is very surprising that even some educators and learners disagree about the rationale of the introduction of group work, while others find it very interesting, useful and important in their teaching and learning of Mathematics.

Table 5: Key elements for Educators

2.Key elements	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
2.1.Maintain independence	1	14.3	2	28.6	5	57.1						
2.2. Accountable to group members					5	71.4	2	28.6				
2.3.Develop reasoning and decision making skills					5	71.4	2	28.6				
2.4.Free participation					5	71.4	2	28.6				
2.5.Peer assessment			1	14.3	3	42.9	3	42.9				

Table 5 reflects a highly positive response of educators about the key elements for successful co-operative learning that 57.1% of educators agree that group work helps learners to achieve good results in developing learners to maintain positive independence in their groups. All educators are positive about responsibility, accountability, free participation, peer assessment skills as well as developing reasoning and decision making skills.

Sutherland et al (1996: 75) say that educators support the fact that group work helps learners to become positively independent when they realise that they have to achieve their goals, while Putnam (1997: 11) also asserts that learners are developed to take responsibility for the task given

by their educators as well as to be accountable for each and every action they do to contribute to their achievement.

Table 6: Key elements for Learners

3.Key elements	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
3.1.Respect member's opinion	5	6.25	17	21.25	29	36.25	25	31.25	1	1.25	3	3.75
3.2.Group work enhances self-esteem	8	10	25	31.25	36	45	7	8.75	3	3.75	1	1.25
3.3.Accountable and responsible	8	10	16	20	40	50	14	17.5	2	2.25		
3.4.Peer assessment	5	6.25	19	23.75	33	41.25	20	25	3	3.75		

Table 6 presents a higher percentage of learners who indicate that learners show respect to other learners' opinion. However, there is a total of about 27.5 % who strongly disagree about this aspect. The concepts of co-operative work and active learning are fairly new concepts that still need to be emphasised and promoted in our schools. As a result some of the responses of the learners may be informed by the old practices of the use of group work which were not effectively and optimally utilised.

If group work is not well implemented, some learners will feel intimidated and therefore lose confidence. On that note, some learners (30%) feel that working in groups does not enhance any self-esteem. Quite a considerable percentage, though, strongly agree that self-esteem is enhanced. This is emphasised by Cangelosi (1992: 238) that group work helps learners to develop cognitive and affective outcomes and learners also strive to learn the subject matter because they discuss and argue on how to get solutions to the given task. This helps learners to develop a wide range of skills such as listening, communication and reporting. Learners also learn to share ideas and to respect others' viewpoints. Learners gain leadership skills, as learners express themselves; this helps them to develop their self-esteem.

Assessment is the key in teaching and learning because it assists in checking on whether learners have gained knowledge or acquired some skills. One of the most pertinent issues has been as to who should conduct it. Peer assessment is also stressed and recommended as one way of practising assessment. This is confirmed in Department of Education (2002: 3) that assessment should provide indications of learners' achievement in the most effective and efficient manner, and ensure that learners integrate and apply skills as well as helping learners to make judgements about their own performance, set goals for progress and provoke further learning.

However, when the environment becomes conducive for learning, learners become free and better able to participate by using their knowledge and abilities for the better performance of the group (Dumas, 2003:4) and (Sutherland et al, 1996: 76).

From the data of both the educators and the learners about the key elements for successful co-operative learning, it reflects that group work helps in the development of learners' responsibilities and accountability of their learning activities, and that educators have major a role in helping learners to respect other learners' opinions in their groups.

4.3.2. Educator's and Learners' responses to research question 1.4.2 (cf page 4)

Table 7: Selection and arrangement for Educators

4..Selection and arrangement	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
4.1.Leadership changes			2	28.6	3	42.9	2	28.6				
4.2.Grouping based on abilities	1	14.3	4	57.1	1	14.3	1	14.3				
4.3. Naming of groups	1	14.3	2	28.6	3	42.9	1	14.3				

Table 7 shows that educators agreed that leadership of learners in groups changes, they do not group their learners according to their abilities and learners are given the opportunity to name their groups while others disagree because grouping learners according to their abilities sometimes demoralises

under-achievers. It also makes learners have low self-esteem because if they are mixed they will be motivated and helped by their group members. However, it is interesting to note that educators group their learners according to their abilities, encourage their learners to participate as well as allowing the learners to take leadership responsibility by rotating leaders in groups.

Table 8: Selection and arrangement for Learners

4.. Selection and arrangement	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
4.1.Naming of groups	16	20	27	33.75	24	30	12	15			1	1.25
4.2.Selection of group members	11	13.75	14	17.5	40	50	15	18.75				

In Table 8, learners agreed that they chose the members for their groups even though they are not given opportunity to name their groups. Despite the data in Table 8, learners who learn in groups name their groups even though some are not given the opportunity to choose the learners they want to study with in their groups. However, this also helps other introvert learners not to be left out when groups are formed as well as helping educators to work on weaknesses and build on strengths such as listening, planning and report-back.

From both educators' and learners' data, the response shows that the educators take part in grouping learners. Learners are also encouraged and given an opportunity to form groups of their own.

4.3.3. Educator's and Learners' responses to research question 1.4.3 (cf page 4)

Table 9: Group management for Educators

5.Group management	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
5.1.Time management is developed					4	57.1	3	42.9				
5.2.Assertive skill is developed					5	71.4	2	28.6				
5.3.Intervenes in conflicts					5	57.1	2	42.9				

The response of educators in Table 9 reflects that the educators agree that group work helps learners to develop time management skills, helps learners to develop assertive skills and that educators intervene in group conflicts. This is confirmed in Table 9 by the educators' response that group work develops learners to be assertive as well as managing their time effectively.

Table 10: Group Management for Learners

5. Group Management	SD	%	D	%	A	%	SA	%	No response	%	Spoiled	%
5.1.Equal contribution in activities	22	27.5	16	20	20	25	21	26.25	1	1.25		
5.2.Conflict caused by groups	15	18.75	23	28.75	27	33.75	13	16.25	2	2.5		
5.3.Leadership changes	8	10	24	30	29	36.25	16	20	3	3.75		
5.4. Receive guidance from the educator	3	3.75	3	3.75	30	37.5	44	55				
5.5.Punctuality	14	17.5	14	17.5	41	51.25	11	13.75				
5.6.Group work develops assertive skills	2	2.5	17	21.25	37	46.25	20	25	4	5		

From the data of learners in Table 10 some learners agree that they are not contributing equally in their group activities, while most of them affirm that they contribute equally, few of them agree that group work causes conflicts among themselves and that group leadership changes.

As indicates in Table 10, a high percentage of learners strongly agree that the educator helps them when they encounter Mathematical problems, they finish their given task on time, and that group work develops them to be assertive. Most learners believe that group work is contributing positively to their achievement through all the involvement that the educators are initiating in their learning process in order to achieve the learning outcomes in Mathematics.

Learners need supervision in every activity they are doing, because if they are not supervised they will not concentrate on the given tasks as confirmed in Table 10. The other problem that might be encountered by educators is fighting amongst the groups. Some of these problems can be reduced and stopped before they can happen as the educators can move around the groups to assess progress, checking if groups are functioning well together as well as checking if learners are following the instructions given.

4.4. INTERVIEW RESPONSES OF EDUCATORS

The responses in this section are based on the use of group work in teaching Mathematics from the educators that I interviewed. The responses are divided as follows:

4.4.1. Teaching strategy used by educators.
4.4.2. The use of group work in teaching Mathematics.
4.4.3. Educators' perception about how learners feel about group work.
4.4.4. Perception about the development of self-esteem and performance.
4.4.5. Comparison of group work with other teaching strategies.
4.4.6. Problems encountered in using group work.
4.4.7. The impact of group work in developing learners to work co-operatively.
4.4.8. Opinions of educators about the use of group work.

4.4.1. Teaching strategy used by educators.

I interviewed the educators about the teaching strategy they use when teaching Mathematics. Some said that they use deductive and inductive methods while most of them use group work even though they don't use it daily, and it depends upon the topics they are teaching. From the educators' response the implication is that educators are aware of group work. They use it but not on a daily basis and the teaching strategies they choose to use depends upon the topic they are teaching. It is not always clear where they will use deductive or inductive methods or even group work.

4.4.2. The use of group work in teaching Mathematics.

I further interviewed the educators about the use of group work in teaching Mathematics and most of the educators use group work while others combine it with discovery even though they don't use it in every topic. Most educators said that group work helps the learners to interact with others and share information, to be actively involved in learning as well as discovering concepts on their own. The implication is that group work has a positive contribution towards the good achievement of both the learners and the educators in their learning outcomes and assessment standards of their activities.

4.4.3. Educators' perception about how learners feel about group work.

All the educators that I interviewed affirmed that learners feel free when they learn and sit in groups, they share ideas and understand each other's weaknesses. This is further confirmed by the first and sixth educators respectively:

Educator 1: "*Yes, because you'll find that sometimes they are free with their peers and they sit close, more close to each other and they become free. They discuss and work together as a group. They work freely in groups.*"

Educator 6: "*Yes, they have a chance of asking friends, they are free to talk to friends where they understand the concepts better as explained by their friends, and they have chance of asking more from their group members.*"

Despite the educators' responses, the learners also affirm that they learn freely in groups as reflected in Table 4 on page 35 that 80% of learners agreed that they learn freely in groups, and that learners find it very interesting as it improves their learning and understanding.

4.4.4. Educators' perception about the development of learners' self-esteem and performance.

All the educators that I interviewed agreed that group work develops learners' self-esteem and performance, this is emphasised by second, fifth and sixth educators as they responded as follows:
Educator 2: "*Yes, if the learners are in a group they feel a little bit relaxed as compared to when they perhaps answer the teacher because when the learner answer the teacher all the other learners will be listening on the answer that the learner is giving to the teacher, and if the answer is wrong at some stage you will find that learners laugh to that specific learner but if he answer in a group and then perhaps the answer is not right, not all the learners are going to be aware of the fact what the answer that that the learner is given is not right. Only the members in that specific group are the ones who are going to hear that wrong answer.*"

Educator 5: "*Yes, group work can develop learners' self-esteem because it can contribute to developing the learners' abilities to organise and manage themselves and their activities responsibly and effectively also to learn. Help learners take responsibility for their own development and also help the teacher to know the area where there are misunderstanding.*"

Educator 6: "*Yes, as for self-esteem, you know the learners turn to think very seriously if they contribute something to their friends for performance, they tend to compete with one another. So, in their groups they would want to contribute and to have more say as a result they increase their knowledge.*"

Based on the educators' response above, it is also confirmed by the learners' response in Table 6 page 37 that 43% of learners agreed that group work develops their self-esteem and Cangelosi (1992:240) further emphasised that group work promotes an atmosphere for growth and promotes confidence.

4.4.5. Comparison of group work with other teaching strategies.

Based on the educators that I interviewed, some of the educators think that group work is better than other teaching strategies while others think that all strategies are good and every strategy depends upon the topic the educator is teaching. This is how the fourth and seventh educators responded:

Educator 4: "*Well for that one I think it depends on which chapter are you treating but group work will be involved but is not so much better than the other ones.*"

Educator 7: "*Not necessary better, all other strategies are better depending again on the concept.*"

In Table 3 on page 34, the respondents reveals that group work is important even though they mix it with other teaching strategies. The positive responses of educators about the use of group work, interest as well as the positive achievement obtained when using group work reflects that group work has better results than other teaching strategies.

4.4.6. Problems encountered in using group work.

Educators encounter problems when they use group work because some of the learners do not participate but they rely on other learners to do the activities and others disturb the groups by making noise because they need supervision. Some of the educators that I interviewed responded as follows:

Educator 2: "*Yes, because at some stage you find that the learners are not busy with the work that you told them to do er, to be busy with. You'll find that some learners are doing something different from the activity that you have given them. The other thing, is not all the learners are actively there participating, other learners are doing the work on behalf of other learners where else at the end of*

the day the whole group is going to benefit even those group members who were not actively involved during the activity."

Educator 3: *"Yes group work can have some problems because there are some noises where involved in group work and er the is no order when they are not properly attended to under supervision."*

Educator 6: *"Yes, in a case where some learners hide behind the others, that is a problem you know they would want the brilliant ones to do the project or the activities so that they get better marks and at the same time they are losing. They don't understand anything."*

4.4.7. The impact of group work in developing learners to work co-operatively.

From the educators' responses about how group work develops learners to work co-operatively, they all agree that group work helps learners to work together responsibly knowing that their participation in the group is contributing towards their positive achievement, it helps learners to respect each others' opinions, accepting one another as well as promoting responsibility and accountability.

This is emphasised by Fraser et al (1993:85) as they assert that group work develops learners ability and skills to communicate while Caprio (1994:256) says it helps learners to share ideas, discuss the problems at hand and agree on a common solution as well as engaging learners to help, assist, support and encourage each others' effort.

4.4.8. Opinions of educators about the use of group work.

The educators that I interviewed had the same opinion about group work, that it must be used for teaching Mathematics, some said that group work is important as it encourages learners to be responsible and accountable for their learning, to respect other learners' opinions, promotes communication amongst themselves and team work as well as working together co-operatively.

In conclusion, the response indicates that some educators use group work, others use inductive, deductive and discovery methods while some combine them and others said that the teaching strategy to be used depends on the topic. Despite the different responses of educators, most of them use group work because they said it helps the learners to understand Mathematics concepts more easily.

Furthermore, the educators agreed that learners learn freely in groups and that group work develops learners' self-esteem, as in groups they learn freely to express themselves, assist one another, to promote responsibility and accountability, and thinking independently. Group work also helps learners to organise and manage their activities as the educators affirmed that learners are developed to work co-operatively in groups because they are encouraged to participate actively, work as a team, to be responsible as well as accepting one another's opinion.

4.5. OBSERVATION SCHEDULE REPORT

I observed seven (7) classes, in which the educators used group work. The response in this section is based on the use of group work in teaching Mathematics about the classes that I observed. The observations are divided as follows:

4.5.1. Beginning of lesson

4.5.2. Presentation of lesson.

4.5.3. End of lesson

4.5.1. Beginning of lesson

The observation that follows reflects how the educators started or introduced their lessons when teaching:

Out of seven (7) classes, in six (6) classes learners sit in groups before the educators can start teaching, which were formed by learners themselves. Learners already had the existing groups. The educators asked learners to sit in their existing groups because the educators said: *"Sit in your groups that you have formed previously,"* and they chose their members. In one other class, groups were not formed before the lesson begins. They were firstly introduced to the topic, then they were

asked to sit in their groups which had been previously formed by their educators and they did not choose members for their groups.

In some classes the topic was introduced to learners by asking learners questions from previous lessons which linked with the topic they were teaching. In other classes the educators introduced the topic to learners by writing it on the chalkboard and explaining some concepts based on the topic. Other educators asked their learners to say what they understood by the topic and others asked learners to discuss the topic amongst themselves, and allow the learners to give their view. Some learners were involved while others were not involved because I observed that there was noise which was caused by learners who were not participating in the given activity.

In some classes learners were given the outcomes of the lesson they must achieve. Others were not given the outcome, they were only told what they were going to do and instructions of the activity were clearly outlined to learners. Learners were discussing freely even though the educators intervened when they were not reaching an agreement in their discussions , or arguments, and others were very quiet. In other classes learners were very relaxed, they were just listening to their group members and just writing something in their books.

The implication is that educators use group work and they allow learners to sit in groups before they introduce the topic. Even though learners are supervised there will always be those individuals who disrupt others and the educators need to give those disruptive learners responsibilities in their groups in order to reduce conflicts and noise.

4.5.2. Presentation of the lesson.

The following observation reflects what I observed during the lessons when the educators were using group work in teaching Mathematics:

Some educators guided the learners in what they are supposed to do in their groups while others did not guide. They did it only when they introduced the lesson. Educators monitored the learners'

participation by moving around the groups to see if they were doing their tasks. The learners shared their ideas and opinions amongst themselves and they also worked peacefully amongst themselves.

Furthermore, the educators managed the groups and intervened so that learners should work peacefully and communicate well with other learners. Groups were also applauded for their good performance and others were encouraged to do well in their activities as responses of the activities had to be written on the chalkboard.

4.5.3. End of lesson

During the conclusion of the lesson, the following indicates what I have observed:

After the learners have done the work in their different groups in all the classes that I observed, they had to report back to other groups in their classes. After all groups had given their responses to the activities, the groups argued, debate and discussed their answers, as some groups were not having the same answers as others. The educators guided the debate to save time and assess the learners' responses. Learners were listening attentively as other groups were giving their reports.

The educators collected the papers where the group responses were written and exchanged them amongst the groups to be marked by learners. Finally, the educators make the final wrap-up on the task done by learners in groups after the responses were marked and returned to group owners.

From questionnaires, the educators' responses show that the educators use group work for teaching Mathematics even though it is not used in all sections or topics in Mathematics and learners enjoy working and learning in groups as they become exposed to different characters and develop assertive skills, accountability and time management. Group work also enhances learners' performance and their self-esteem.

The interview responses of educators also affirm that they use group work, but depending on the topic they are teaching, and that group work has a positive contribution towards good achievement of both the learners and the educators even though they do encounter problems in using it, but

group work helps learners to understand Mathematics concepts better if taught or helped by their fellow learners.

Educators are using group work even though they find it very challenging when using it because of some learners who are not cooperating with other learners when they are given activities to be done in groups. Educators monitor groups and intervene when learners argue on a point which they cannot agree upon. Learners are given chance to give report to other groups so as to debate ideas on what they are doing in groups.

A summary of findings, recommendations and conclusion based on both learners and educators' responses will be outlined in the next chapter.

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1. Introduction

A brief summary of this study is presented in this chapter. There is also a reflection on major findings of the study, as well as recommendations for the improvement of the present situation about the use of group work in the teaching of Grade 9 Mathematics of Botshabelo Cluster in Mafikeng APO, North West Province.

5.2. Summary of Findings

The findings of the research are the following:

From this chapter, findings were identified based on the research questions in page 5 on how to overcome problems in using group work as a teaching strategy and what can be done to improve the use of group work in teaching Mathematics.

In classrooms, there is no physical creative learning space for group work as it hampers teaching and learning. Lack of learners' and educators' resources results in less stimulation of learning and this results in inactive participation of learners in groups. There is no discipline, so much time is wasted because learners are not disciplined. Educators are insensitive to racial and gender diversity. There is little evidence of goal-setting to achieve outcomes. The educator's competency in planning for group work as well as management of groups is poor.

Educators use group work in teaching Mathematics. The use of group work enhances learners' performance. Group work brings positive achievement and maintains independence to learners. Learners enjoy learning in groups and participate freely in their groups. Educators find it difficult to use group work because of overcrowded classes. Group work is less effective because the low self-

esteem of some learners reduces group participation. Selection of members by learners to form groups causes group conflict. Learners are not assertive and educators intervene in group conflicts and guide them. Time is not managed effectively in group activities.

5.3.Recommendations

Based on the findings on the research, it is recommended that Department of Education should plan more workshops on the use of group work for the Mathematics educators. The Educators' role is important in developing learners' group participation. It is therefore important that educators use effective methods when teaching Mathematics, for example, the educators should set their Learning Outcomes and help learners to feel accepted in their groups.

HOD's need to encourage the educators to use group work in teaching Mathematics as learners enjoy working with other learners and they learn freely. Learners should be encouraged to learn in groups as it enhances their performance. Educators need to reduce their classes to a manageable size. Learners need to have their self-esteem developed through participation. Educators need to intervene in conflicts and form groups for learners to avoid isolation of introverted learners. Time management should be effective in order to avoid wasting time. Learners need to be developed to be assertive in order to be responsible.

Educators need to be encouraged to allow their learners to sit in groups as this is also supported by constructivism, where learners are given opportunity to lead the group by making presentation in the class about the given activities.

Furthermore, the educators also need to motivate their learners to work in groups by giving awards to the responsible groups that do and submit their activities on time and the groups that are accountable for their action. The educators need to create a conducive environment for learners to learn in groups even though they are overcrowded, as well as intervening in groups when learners argue about an issue and learners do not reach agreement by further reducing conflicts in groups. Whether the classes are overcrowded or not, educators are encouraged to move around the learners when they are given activities, because if they are not monitored they will lose focus, disrupt other

groups, waste time and even cause conflict amongst themselves. This will give the educator the progress of the groups about the given activities. This will also help the educator to check the weaker learners and may re-group them accordingly so that they must learn at their own pace, not be left behind if they are not grouped accordingly to their abilities.

Furthermore, educators need to help learners save time to reach the targeted time for their activity rather than wasting time arguing on an issue. As learners are encouraged to work cooperatively by the educators, they will be able to do their activities successfully and this will also develop in learners the skill of working together, listening skills, tolerance for each other, respecting each other, being polite and caring as well as accepting criticism from the peers in their learning groups.

Educators should give out instruction of the activities to be done by learners clearly and make sure that the learners has understood it very well as it will save the time of learners to be actively on-task.

Another recommendation will be that the educators change leadership of groups as this will help in developing the learners' self-esteem, confidence, independence, conflict management skills, self-reliance, sense of responsibility, to be assertive as well as becoming good decision-makers and develop problem-solving skills.

Peer assessment and group assessment should be used by educators so as to help learners make judgments about their own performance, set goals for progress and to provoke further learning and promotes good competition spirit amongst the learners.

Educators need to be encouraged to use group work in most sections of Mathematics as OBE is encouraging the learning process to be dominated by learners rather than the educators. This means that the educators are the facilitators of the learning process, in which the educators must make sure that the activities that are given to learners must be challenging so that no learner will be found idling, making noise or disturbing others, they must all be involved and be on-task.

5.4. Conclusion

It was observed that educators have high numbers of learners in classes to teach in Grade 9 which make them unable to use group work effectively. Others learners have difficulty in working in groups. Educators need to form groups for their classes to avoid isolation of the introverted learners.

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APPENDICES

***APPENDIX ONE*: Letter of permission to heads**

P.O. Box 2139
MAFIKENG
2745
(018) 381 7028
……..

The Principal

……

……

Sir / Madam

Re: A research on the use of group work in the teaching and learning of Mathematics in the middle schools

I am a Masters student of the North West University (Mafikeng Campus). I am conducting a research with the purpose of identifying the use of group work in the teaching of Mathematics.

There are two types of questionnaire for this research. The first is to be answered by 10% of Grade 9 learners in your school and the second is to be answered by their Mathematics educators. I also need time to observe how Mathematics educators uses group work in their teaching.

I will be grateful if you would help me. Thanking you in advance.

Yours faithfully

_____

Mathepa Salamina

APPENDIX TWO

EDUCATOR'S QUESTIONNAIRE ABOUT THE USE OF GROUP WORK IN TEACHING GRADE 9 MATHEMATICS

The purpose of the questionnaire is to gather information on the use of group work in the teaching of grade 9 mathematics in the selected middle schools. This information will be strictly used for my Masters Degree with North West University in Mafikeng campus, therefore anonymity and confidentiality is assured. Hence, you are requested to be free, honest and faithful in your responses, as your input will help to enhance teaching and learning.

SECTION A

This section seeks to establish the importance and use of group work in teaching Mathematics.

Please rate the degree of effectiveness of the following use of group work by making a cross (x) at the most appropriate key.

KEY: 1 = Strongly Disagree (SD) **2 = Disagree (D)**

3 = Agree (A) **4 = Strongly Agree (SA)**

1. Rationale for the introduction of group work as strategy for teaching mathematics	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
1.1.Groupwork is essential for teaching mathematics				
1.2. Learners find group work interesting				
1.3.Groupwork brings positive achievement				
1.4. You use group work for teaching mathematics				
1.5. Always use group work				
1.6. Learners achieve learning outcomes in their groups				
1.7. Group work enhances the learners' performance				

2.Key elements for a successful co-operative learning	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
2.1. Learners maintain their independence within the group				
2.2. Learners are accountable to group members				
2.3. Group work helps learners to develop reasoning and decision making skills				
2.4. Learners participate freely				
2.5. Group work allows for peer assessment				

3. Selecting and arranging groups	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
3.1. Group leaders are changed				
3.2. Learners are grouped according to their ability				
3.3. Learners choose names for their groups				
3.4. Learners are encouraged to participate in their groups				

4. Managing group differences	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
4.1. Group work helps learners to develop time management skills				
4.2. Group work helps learners develop assertive skills				
4.3. Teacher intervenes in group conflicts				

SECTION B

5. In your opinion, how can the use of group work influence both the learners and educators in the learning and teaching of mathematics?

_____

_____

_____

6. What do you think should be done to encourage mathematics educators to use group work?

_____

_____

_____

APPENDIX THREE

LEARNERS' QUESTIONNAIRES ON THE USE OF GROUP WORK IN TEACHING GRADE 9 MATHEMATICS

The following information is necessary for research purposes. Please answer the questions frankly and accurately as possible. All responses will be kept confidentially. Your co-operation will be highly appreciated.

Instructions:

Read each question carefully and make a cross (x) on the appropriate box of the answer that applies to you. If a blank space follows a question, please write in your answer.

SECTION A

This section seeks to establish the importance and use of group work in learning Mathematics.

Please rate the degree of effectiveness of the following use of group work by making a cross (x) at the most appropriate key.

KEY: 1 = Strongly Disagree (SD) **2 = Disagree (D)**

3 = Agree (A) **4 = Strongly Agree (SA)**

1. Rationale for the introduction of group work as strategy for teaching mathematics	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
1.1.Learners participate freely in group work				
1.2. Group work is interesting				
1.3.Groupwork improves learners' performance				
1.4. You sit in groups in classroom				
1.5. Activities are done in groups				
1.6. Always learn mathematics in groups				
1.7. Group work learning is better than individual learning				

1.8. Group work will improve your learning and understanding mathematics				

2.Key elements for a successful co-operative learning	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
2.1. Group members respect your opinion				
2.2. Group work enhances your self-esteem				
2.3.Group members are accountable for their responsibility				
2.4. In group work learners assess their friends' work				

3. Selecting and arranging groups	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
31. You choose names for your groups				
3.2. You choose members for your groups				

4. Managing group differences	**1**	**2**	**3**	**4**
	SD	**D**	**A**	**SA**
4.1. Group members contribute equally in group activities				
4.2. Group work causes conflict				
4.3. Group leader does not remain one person in all activities				
4.4. Teacher helps the groups when encountering mathematical difficulties				
4.5. Groups finish their given task on time				
4.6. Group work develops assertive skills				

SECTION B

5. In your opinion, does group work influence your performance?

_____

_____

_____

6. What do you think teachers can do in order to develop learners to work in groups?

_____

_____

_____

APPENDIX FOUR

INTERVIEW SCHEDULE

1. Which teaching strategy do you use for teaching mathematics, and how often?
2. Which teaching strategy do you think can help your learners to understand Mathematics concepts better and why?
3. Do you use group work in teaching Mathematics?
4. Do you think learners learn freely in groups?
5. Do you think group work can develop the learners' self-esteem and their performance? Explain.
6. Is group work better than other teaching strategies for teaching Mathematics?
7. Do you encounter problems in using group work?
8. How does group work develop learners to work co-operatively?
9. What is your opinion about the use of group work in teaching Mathematics?

APPENDIX FIVE

OBSERVATION SCHEDULE

Observation form for group work teaching

Observer: _____

Educator observed: _____

School: _____

Number of learners: _____

In this method the researcher makes some observation in the lesson about the events being observed and enter responses onto a rating scale by making a cross (X) in the appropriate key.

KEY: 1 = Not at all; 2 = Very little; 3 = A little; 4 = A lot;

5 = A very great deal

1. START OF THE LESSON

	1 Not at all	**2 Very little**	**3 A little**	**4 A lot**	**5 A very great deal**
1.1. Teacher formed the groups before starting the lesson					
1.2. Learners chose group for themselves					
1.3. Teacher introduces the topic to learners					
1.4. Teacher allows learners to discuss the topic before he/ she introduces it to learners					
1.5. Teacher makes learners feel comfortable					
1.6. Learners discuss freely in their groups.					
1.7. Teacher gives learners outcomes of their activity					
1.8. Teacher's instruction for the activity is clear to the learners					

HIGHEST SCORE	**45**				
SCORE OBTAINED					

2.PRESENTATION OF THE LESSON

	1 Not at all	**2 Very little**	**3 A little**	**4 A lot**	**5 A very great deal**
2.1. Teacher guides learners on the concepts they are busy with					
2.2. Teacher monitors the groups as they discuss					
2.3. Teacher allows learners to say their opinions					
2.4. Learners are participating equally in groups					
2.5. Learners are given time to write something on the chalkboard or to report back about their task					
2.6. Teacher manages the group well					
2.7. Learners are encouraged to work in groups peacefully					
2.8. Teacher intervenes to stop misbehaviour					
2.9. Teacher praises the group for their performance					
2.10. Teacher communicates well with the learners					
HIGHEST SCORE	**50**				
SCORE OBTAINED					

3. END OF THE LESSON

	1 Not at all	**2 Very little**	**3 A little**	**4 A lot**	**5 A very great deal**
3.1. Groups report back to the class					
3.2. Learners discuss and argue about other groups' report					
3.3. Teacher guides and assesses the report from different groups					
3.4. Teacher wraps-up all the tasks					
3.5. Learners submit their tasks for marking and assessment					
3.6. Assessment is done by other learners (Peer assessment)					

3.7. Groups listen attentively when other groups give their report					
HIGHEST SCORE	**35**				
SCORE OBTAINED					

GRAND TOTAL SCORE	**130**
GRAND TOTAL SCORE OBTAINED	

Signature of Educator observed:_____

Date: _____