Exploring Teaching Strategies Used by Grade 8 Mathematics Teachers to Teach Probability

by

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Declaration

I, Bonisile Teressa Khathi, declare that the research reported in this dissertation for Master's degree in Education, titled **Exploring Teaching Strategies Used by Grade 8 Teachers to Teach Probability,** is my own work; and all sources used have been acknowledged in- text and in the reference list accordingly.

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As the candidate's Supervisor I agree to the submission of this dissertation.

Dr L. R. Maharajh

ABSTRACT

The reason why probability is being taught in our schools has been explained in many articles. This study presents the strategies used by grade 8 teachers to teach probability, adding different sources, which are, literature, interviews, and lesson observations. The assumption made in this study is that teachers do not have proper training in probability to successfully teach it to grade 8 learners. The study employed a qualitative approach to understand teachers' insight into teaching probability to grade 8 learners. The study constituted of 2 participants, each from a neighbouring school from the same circuit in the Pinetown district in the KwaZulu- Natal province, South Africa. Two instruments; interviews and observations, were used to collect data in this study. The findings of this study indicate that the learning approaches of the participating teachers were limited. There was, for example, no use of a problem based approach to reinforce essential aspects that enable learners to understand probability. Code-switching and re-voicing were most frequently used practices seen in the findings to encourage learner participation. The study recommends that more research needs to be done on effective probability approaches and the study also recommends methodology courses especially of probability to be offered for high school teachers.

Key words: Teaching strategies, mathematics, grade 8 probability, teaching and learning approaches, essential aspects and effective principles

PREFACE

The work described in this thesis was carried out in the School of Education

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ACKNOWLEDGEMENT

I would like to thank my Heavenly Father, for having given me such strength and courage to complete my master's dissertation. I would sometimes cry when I am alone in my bedroom and my cry would be directed to my Heavenly Father to please intervene, and I have seen His hand upon me. I would also like to express my gratitude to my Supervisor Dr Lokesh Ramnath Maharajh for the caring support he has given me. He gave me hope through his guidance and knowledge he imparted on me. To my family I love you so much, you were my inspiration, and I had to be a good example for you.

Dedication

This thesis is dedicated to my own mother Thandi Mavis Mthethwa for the support she gave me, to take care of my 9 year old daughter. To my husband, who has been so understanding, who would do all for me and even cook for the family. I am truly blessed and words cannot express my sincere gratitude. To my children Ntuthuko, Nkanyezi, Nhlakanipho and Nonzuzo Khathi for the encouragement, support and understanding they showed me.

CHAPTER 1

1. INTRODUCTION TO STUDY

1.1. Introduction

The South African Curriculum aims to ensure that learners acquire and apply knowledge and skills in ways that are meaningful to their own lives (Education, 2011). One of the ways to acquire these, is for teachers to use a variety of methods (strategies) to improve the quality of their teaching of mathematics.

Malan, Ndlovu and Engelbrecht (2014) indicate that if contextual problem-based learning is integrated into the curriculum, then students' learning patterns may be influenced in a favorable direction. Problem-based learning is one of the teaching approaches that teachers could use to make learning meaningful and to lead to the construction of new knowledge. This would be possible if teachers made their lessons learner-centred. As such the success of the lesson depends on the role played by the teacher in the teaching and learning particularly in relation to probability.

Probability was optional in the National Curriculum Statement (NCS) (2005), but is now compulsory for all learners in the amended NCS known as Curriculum Assessment Policy Statement (CAPS) (2012), with first examinations done in the year 2013. Given this change I was intrigued to find out the strategies teachers use to teach this new component especially in schools that were not opting for paper 3 which was previously an optional paper in matric under the old National Curriculum Statement (NCS).

The matric results of 2014 released by Umalusi showed a decline in the mathematics national pass rate (Morkel, 2014). One of the reasons given for the decline is the introduction of Euclidian Geometry and Probability in the new syllabus (Morkel, 2014). It is therefore worthwhile to find out what strategies teachers are using to teach probability given the change of syllabus that has occurred.

Teaching mathematics involves both in-depth understanding of the content and how to impart the content. Mason & Spence (1999) suggest that knowing- about 'mathematics and mathematics teaching is achieved through knowing- to act' during the practice of

teaching and learning situation (p.135). In other words, content knowledge and methods of teaching mathematics should complement each other in order for effective learning and teaching to take place. It was therefore important to consider what the teacher made available for learning and how this knowledge was imparted in the classroom situation.

In this study I explored the teaching strategies used by teachers to teach probability to grade 8 learners. This was done in an attempt to describe, understand, and analyse how the quality of teachers' practice could be improved, particularly in relation to how essential aspects are enforced. The focus of this study also included how appropriate strategies and guiding principles are implemented in teaching probability. This chapter presents the rationale for the study, importance of the study and the outline and organisation of each chapter.

1.2. Location of the study

The study was conducted in the KwaZulu-Natal province, South Africa and the setting is an urban area of KwaMashu. The schools are matched as institutions that are previously disadvantaged communities. The teachers and learners from both participating schools are IsiZulu first language speakers. The participants were two mathematics teachers, both experienced males. The name of the schools were school A and school B and the study was conducted for one year only, 2017.

1.3. Rationale for this study

I have observed that educators teaching mathematics at various levels (grades) are struggling to adapt with curriculum change and new technology and their voices are neglected or ignored. Therefore there is a need to explore teaching strategies used by mathematics teachers, to better understand the challenges faced by teachers in general. I have also observed that most of the research done in teaching strategies used by teachers in mathematics focus on the intermediate phase. There are very few studies that have been done specifically on teaching strategies used to teach probability (Elbers, 2003).

In my school in grade 12 learners' career choices tend mostly to be related to sciences and engineering and we know that one of the main requirements is to pass with a C symbol (60% and above) in order to be accepted in the sciences and engineering

department. The majority of learners in my school are from disadvantaged families. Most of their parents are uneducated and unemployed and consequently mostly rely on teachers for their children's education achievement or dreams. It is therefore crucial that teachers who are the key role players deliver effectively for learners' positive results. The teachers therefore need to use effective teaching strategies, share their knowledge, skills and experiences to support learners and parents. This will also help learners in general at the schools in particular to improve the pass rate in mathematics.

The core purpose of the study was to explore teaching strategies used by mathematics teachers in grade 8 in two secondary schools in KwaMashu. There is an overall impression that mathematics results in grade 12 are not of high standard. According to Naidoo (nd) learners are expected to write a common national examination at the end of their grade 12 year in mathematics or mathematical literacy regardless of glaring inequalities within the school milieus across the country. Very few learners achieve a university entrance pass rate. This study focused on two KwaMashu secondary schools that I have identified as a sample.

Being a mathematics teacher in grade 12 for the last 16 years, I have observed learner achievement in mathematics is low and that learners come to grade 12 with no understanding of probability. As an experienced marker of grade 12 papers I have discovered that questions that touch on probability are not being answered by many learners whereas probability starts from the intermediate phase. I thought it would be much better if my study is done with strategies used by grade 8 teachers to teach probability, rather doing it with grade 12 when already the damage has occurred. I judged grade 8 as the start of the senior phase where learners need to be alert for the coming grades.

1.4. Significance of the study

The study may inform teachers about the importance of careful preparation in terms of choosing tools and examples to teach learners. I also think other stakeholders like curriculum designers; mathematics researcher scholars and other interested parties in education in general may find the study informative about the current exemplification practices of teachers in South African schools.

1.5. Outline and overview of chapters

- **Chapter 1: Introduction**

This chapter provided an overview of the study's location, rationale and significance of the study.

- **Chapter 2: Literature Review**

This chapter provides a review of related literature which focuses on the topic of this research. Both local and international literature was reviewed. This chapter is presented in 7 sections, the introduction of the chapter, curriculum change in South Africa, background to mathematics, teaching strategies in general, teacher-centred strategies, learner-centred strategies and teaching strategies used in probability.

- **Chapter 3: Research design and methodology**

Chapter three discusses the research methodology adopted in this study. This chapter is presented in 10 sections, the introduction of the chapter, research approach, and research paradigm, location of the study, sampling, data gathering, data analysis, trustworthiness, ethics and limitations.

- **Chapter 4: Data presentation**

This chapter provides a brief description of the analysis and interpretation of the collected data. Content analysis was used to make sense of the data generated from the participants. The findings are presented under the categories and themes that emerged from the literature and the analytical process.

- **Chapter 5: Summary and conclusion**

A brief discussion on the key findings and conclusions made in this study are provided.

1.6. Conclusion

This chapter has given an overall picture of what the study seeks to explore and has presented the rationale and the purpose of the study. I have also outlined the significance of the study. The next chapter will focus on the theoretical framework that informs the study as well as some existing literature related to the study. In chapter three methodology issues will be dealt with. These include research design, data collection methods, validity and reliability and ethical considerations. Chapter four

looks at the analysis findings. Chapter five then concludes the study by looking at the conclusions, recommendations, limitation of the study and reflections.

CHAPTER 2

2. LITERATURE REVIEW

2.1. Introduction

In this chapter the researcher presents a literature review of the teaching strategies that are used by grade 8 mathematics teachers to teach probability in their mathematics classroom. The research questions are:

- What are the teaching strategies used by teachers to teach probability?
- How are these strategies used to teach probability?

This literature review is going to be done in a thematic way, which will be divided into six main themes. In the first theme I will talk about the curriculum placing some emphasis on explaining different kinds of curricula that have played out in South Africa. The second theme presents a discussion on the background to mathematics. The third theme would cover teaching strategies in general and I will elaborate on the views of other researchers about teaching strategies. The review will then proceed to the fourth theme which looks at the teaching strategies in the general theme which talk about the teaching strategies specifically used by mathematics teachers. The fifth theme would present teacher-centred strategies and the sixth theme portrays the learner-centred approach. The final part concludes the chapter and provides a brief summary of the first six themes.

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2.2. Curriculum change in South Africa

According to Van den Akker, de Boer, Folmer, Kuiper, Letschert, Nieven and Thijs, (2009, p. 9), curriculum as a "plan for learning" is divided into SUPRA (international level of curriculum), MAKRO (National level of curriculum), MESO (Institutional/School level of curriculum), MICRO (Teacher/classroom level of curriculum) and NANO (Student individual level of curriculum). Each of these levels can be defined in terms of intended curriculum (for curriculum developers), implemented curriculum (for teachers) and attained curriculum (for learners). The intended curriculum consists of ideal (vision/rationale) and formal written (intentions as specified in documents components). The implemented curriculum consists of perceived (curriculum as interpreted by teachers) and operational (the actual process of teaching and learning or curriculum in action) components. The attained curriculum

consists of experiential (learning experiences perceived by students) and learned (resulting learning outcomes of students) components.

The ‘roll out’ of a curriculum is not a smooth passage and teachers will not easily adopt all the requirements. When the new democratic government came into power in 1994, it had to redress the previous curriculum. Resolving problems is not an easy issue, so the democratic government searched for the right curriculum that would make South Africa compete with other best countries in the world and also to gain that recognition (Rogan and Aldous, 2004). The development of new curricula is a common event in countries across the globe: i.e. the curriculum in South Korea has been changed and revised seven times since its first implementation in 1946 (Gerhard van der Wal, 2015). In many cases these curricula are well designed, and the aims are intended to achieve are laudable, however the attention and energies of policy makers are focused on the “what” of the desired change, neglecting the “how”.

According to Kodisang (2015) South Africa adopted a constitution (Act 108 of 1996) that provided the basis for curriculum change. The kinds of curriculum that took place in order to position our education on par with other countries, in their chronological order are Curriculum 2005 (C2005), the Revised National Curriculum Statement (RNCS, 2002), the RNCS was then replaced by National Curriculum Statement (NCS, 2011) which operated from grade R-12. The apartheid government favoured the white race at the expense of other races. Therefore the new government had to undo the injustice that was propagated by the previous government even in the education sector. The ministers of education appointed over the last twenty or so years had to make sure that the curriculum introduced at school would be that of uniting all citizens as equals in a democratic and prosperous South Africa. Therefore this suggests that the new curriculum was to serve as an instrument for new political vision. Gal (2009) presents an analysis of how the South African curricula advocates the use of real life examples to teach probability at the same time places more emphasis on examples that neglect real-life situations.

2.3. Background to Mathematics

Mathematics in the K to 12 curriculum is a skill subject. By itself, it is all about quantities, shapes and figures, functions, logic and reasoning. Mathematics is also a tool of science and a language complete with its own notations and symbols and "grammar" rules, with which concepts and ideas are effectively expressed. Mathematics is connected to the real world, makes a unique contribution to human knowledge, can be done by everyone, and is fun and thought provoking. Education and training during apartheid was characterised along the lines of race particularly mathematics depriving the blacks from having the same mathematics as whites. The under-development of human potential, generally, of blacks in particular was subject to the apartheid government. The teaching and learning of mathematics, science and technology were the hardest hit (Department of Education (DoE), 2001 a). This suggests that mathematics during apartheid times was not meant for black people. Basically the 1954 Bantu Education Act promoted segregation of education.

The advent of democracy in South Africa brought huge changes especially regarding education which is now the same for all races. Education reformers in South Africa are concerned about the comparisons of South African learners with those of other nations, with respect to the apparent inability of South African youth to successfully participate in the mathematical global market place (Howie, 2003; Reddy, 2006). This suggests that the apartheid system had a strong impact. The majority of South African people are blacks, since blacks were oppressed means South African mathematics education is still on a process of recovery and is still not on a level comparable with other nations.

Mounting indicators on school performance and teaching reveal largely unacknowledged poor teaching of mathematics in the great majority of schools. Poor teaching competencies and, as an extension, learner results will not quickly be remedied. (Centre for Development and Enterprise (CDE), 2013).

The previous syllabus (apartheid syllabus called traditional) emphasised content knowledge rather than integrated classroom learning experiences of knowledge, skills and attitudes. Mathematics teachers during apartheid tended to place too much focus on the instructional strategy, where the teacher is the one who does the talking, while the

students listen; this may still be the norm in today's classrooms. The present day teacher spends most of the time talking and explaining when he or she should rather adopt approaches that are less dependent on transmission and are more participatory (Sfard, 1998) cited by Gerhard van der Wal (2015). This suggests that it is difficult for teachers to move to today's syllabus which emphasises integrated classroom learning experiences of knowledge, skills and attitudes. Consequently the relevant question is when will South Africa begin to break the pattern of producing largely innumerate young people who lack the skills needed for all?

There has been a growing recognition of the importance of the early years for the acquisition of mathematical skills in South Africa. The realisation that a strong foundation is needed if children are to be successful in learning mathematics at higher grades prompted the Department of Basic Education (DBE) to conduct systematic evaluations in mathematic competency at primary schools. Although the poor outcome of the Annual Mathematics Assessment (DBE, 2012) is symptomatic of dissatisfactory performance levels in the Foundation Phase research at this level remains scarce. It appears that good mathematical skills are learnt later in the school in numerous studies (Department of Basic Education, January 4 (2012:3) as sited by Machaba, 2013)

2.4. Teaching strategies in general

Teaching can be defined as a way of conveying a message. According to Smith (2016) teaching is the process of attending to peoples' needs, experiences and feelings, and making specific interventions to help them learn particular things. Teaching strategies are aimed at assessing learner needs and also finding the connection between where the learner is and where the teacher is and what the teacher wants them to do (Toker et al., 2013).

Teaching strategy can also be defined as a careful plan or method for achieving a particular goal usually over a long period of time. According to Etkind and Shafrif (2013) teaching strategies are a variety of teaching techniques or methods used by teachers to improve learners' learning. Teaching strategy comprises the principles and methods used for instruction. The choice of teaching strategy or strategies to be used depends largely on the information or skill that is being taught and may also be

influenced by the learning style, aptitude, skills and enthusiasm of the learner. When a teacher prepares a lesson it is important to be aware of these learning styles so that he/she can choose appropriate teaching strategies.

Killen (2012) defines teaching strategies as different ways of helping learners to learn or achieve a particular goal. This suggests that teaching strategies are the methods or techniques that the teacher uses to teach content knowledge in the classroom and to transfer this knowledge to the learners. He further states that there is no single strategy that is effective for all learners in all situations. Berkvens et al. (2014) explain that teachers should make education an exciting adventure for learners by utilising different teaching strategies and by bringing real life situations into the classroom.

According to Antony and Walshaw (2009), teaching strategies involve all activities in and out of the classroom like arranging learners into groups, building on learners' thinking, doing worthwhile mathematical tasks, making connections, assessment for learning, mathematical communication, mathematical language, tools and representation, and teacher knowledge.

Kazima (2006a) also states the fact that "teachers must be able to select and clarify appropriate mathematical goals for any lesson taught, sequence mathematical tasks and be able to evaluate the mathematical worth of a learner's explanation or argument". This statement suggests teaching needs thorough preparation in terms of how the lesson should be assessed. The context of the classroom will therefore determine what teaching strategies should be used.

Teaching strategies can best be understood in relation to the education system in which they are used. Different education systems bring with them different demands and expectations, so the teaching strategies used are influenced by these systems. To fully understand where we are going we have to take a look at where we are coming from, thus one starts by looking at traditional education.

A strategy used by teachers in traditional education was known as "direct instruction". Gerhard van der Wal (2015) postulates that although this is partly true there are still many cases where direct instruction is part of the mathematics classroom; some teachers

feel that the demand of the curriculum requires direct instruction, where they can relay the information faster to the students. There are still teachers who rely on direct instruction as a useful and effective teaching strategy.

According to Killen (2006) sited by Gerhard van der Wal (2015) the following teaching strategies apply to the modern classroom: (i) direct instruction, (ii) discussion, (iii) small-group work, (iv) co-operative learning, (v) problem solving, (vi) research, (vii) role play, (viii) case study and (ix) writing. Direct instruction involves the direct transfer of knowledge from the teacher to a learner, with the teacher doing most of the talking. The teacher leads the instruction and the focus is on acquiring factual knowledge which leaves few opportunities for the students to initiate activities.

Discussion can be explored in any classroom environment by learners to test their own ideas against those of other learners. It is a good way to learn from different perspectives of the same information which can help guide learners to understand. The learners can express their own opinions and give other learners their views on the topic. The teacher will facilitate the discussion and guide the discussion in the right direction if it deviates from the topic.

Small-group work is an activity that focuses on the learners and the teacher should facilitate and give guidance to the different groups (Killen, 2006). These groups can differ in size, depending on the classroom and desk setup but average group sizes are usually three to six learners. Learners can work together and by doing so they acquire social skills as well as intended knowledge. Small-group work initiates many activities which include small-group discussion, completing worksheets, solving problems or making presentations.

Co-operative learning can take place between two learners or small groups. Learners learn from each other and teachers should group or pair learners who will work effectively together. This encourages learner-to-learner interaction, and can help team members to establish a supportive relationship. It further favourably benefits both learners and the teacher (Huetinck, & Munshin, 2000, p.15).

Problem-solving is a strategy that is widely used in mathematics classrooms. Learners should solve problems themselves using their prior knowledge to lead them towards a solution. Problem-solving encourages learners' ability to produce their knowledge and to show that they have assimilated it by solving problems. This topic will be further discussed at length under the next heading.

Research can be used as a teaching strategy to promote self-learning and allow the learners to discover new information on their own. Research can take the form of an investigation or guided research using materials such as books or the internet. It can also be combined with case studies. Research can lead the student to discover new methods and information, thus giving the student a broader perspective which will enable the student to retain new information when it is transferred from the teacher.

Role-play is effective as a teaching strategy as it helps the learners to gain confidence and grasp knowledge and use it in an everyday situation. Role-play can be used to create a particular scenario and brings a kind of realism to the classroom. This helps the learners solve problems and use the knowledge that they have acquired in a situation that resembles a real life situation. Role-play can help the learners understand information better and to see its value.

Case studies provide real-life scenarios as the learners learn from these experiences, put their knowledge to good use and build on their current experience. Case studies can provide useful information that is not in the textbook and can be combined with research, small-group work or co-operative learning. This strategy can be used to gather data in real-life situations and analyse the data using problem-solving methods. This can help the learners apply knowledge from the classroom and analyse data to present useful information.

Writing is a good way of testing the students' knowledge and their understanding as it reveals their ability to write and tests whether they can relay information effectively (Killen, 2006). Through writing learners can represent their opinions and also deal with problems that they might encounter in the mathematics classroom. In the next section teacher-centred strategies followed by learner centred strategies are discussed.

2.5. Teacher-centred strategies

It has been suggested by Brown, Lake, & Matters (2009) that teacher-centred and learner-centred orientations may be parallel emphases, meaning that teachers can simultaneously believe in being both teacher-centric and learner-centric methods.

In a traditional classroom, learners become passive learners, or rather just recipients of teachers' knowledge and wisdom. They have no control over their own learning. Teachers make all the decisions concerning the curriculum, teaching methods, and the different forms of assessment. Duckworth (2009) asserts that teacher-centred learning actually prevents students' educational growth. In contrast, in a learner-centred classroom, students are actively learning and they have greater input into what, how and when they learn it. This means that students take responsibility for their own learning and are directly involved in the learning process. A learner-centred teaching style focuses on how students learn instead of how teachers teach (Weimer, 2002, and Wohlfarth et.al, 2008). In a learner-centred classroom, teachers abandon lecture notes and power point presentations for a more active, engaging, collaborative style of teaching (Wohlfarth et.al, 2008).

During the last few decades, a teacher-centred teaching style has been replaced by a learner-centred teaching style in higher education (McCombs & Whistler, 1997; Weimer, 2002).
Instruction is most suitable for the more autonomous, and more self-directed learners who not only participate in what, how, and when to learn, but also construct their own learning experiences. The learner-centred approach reflects and is rooted in a constructivist philosophy of teaching (Brown, 2008; McCombs & Whistler, 1997; Weimer, 2002, and Schuh, 2003).

The teacher centred (traditional) classroom often looks like a one-person show largely with uninvolved learners. Traditional classes are usually dominated by direct and unilateral instruction. Teacher centred-strategy followers assume that there is a fixed body of knowledge that the learners must come to know. Learners are expected to blindly accept the information they are given without questioning the instructor (Stofflett, 1998). The teacher seeks to transfer thoughts and meanings to the passive

student leaving little room for student-initiated questions, independent thought or interaction between students (VAST, 1998). Even in the activities based subjects, although activities are done in a group they do not encourage discussion or exploration of the concepts involved. This tends to overlook the critical thinking and unifying concepts essential to true science literacy and appreciation (Yore, 2001). This teacher-centred method of teaching also assumes that all students have the same level of background knowledge in the subject matter and are able to absorb the material at the same pace (Lord, 1999).

In fact, repeated research has found that teacher-centred lessons may be less or non-productive, and in some cases, detrimental to the students' learning process (Zoller, 2000). Many teachers are hesitant to try the constructivist model, because it requires additional planning and a relaxation of the traditional rules of the classroom (Scheurman, 1998)

2.6. Learner-centred strategies

A learner-centred strategy, is a model which puts the learners in the centre of the learning process. Learner-centred learning is a model in which learners play an active role in their own learning styles and encourages learners to learn and how to improve skills such as critical thinking, problem-solving and reflective thinking. Students apply and display different styles**.** Lerner-centred learning environments provide interactive, complementary activities that enable individuals to address their unique learning interests and needs and examines content at multiple levels of complexity

In a learner-centred strategy, learners are the initiators and architects of their own learning and knowledge making, rather than passive 'vessels' who receive knowledge from expert teachers (Brown, 2008). In learner-centred learning, the teacher takes a more active role in learning rather than being the person in the centre of knowledge. Learner-centred teaching has brought about the change in questions from "What should we teach?", "How should we teach?", and "With what should we teach?" to a perspective where "What would s/he like to learn?", "What will s/he do to learn?", "What would assist him/her in his/her learning?" Donald, Lazarus and Lolwana, (2010:81) contend that constructivism is a view of knowledge as being actively

constructed (by individuals, groups and societies), not simply transferred. The scholars further state that it constitutes the interest and the will to achieve, or to take on anything. Constructivism sees human beings "as active agents in their own learning" meaning that knowledge is not passively received but actively constructed. Through engaging in experiences, activities, and discussions which challenge the children to make meaning of their social and physical environment, learner-centred strategies focus on developing learners' existing ideas, encouraging them to construct their own knowledge, and develop their understanding (Trigwell, 2012).

Children are actively engaged in building a progressively more complex understanding of their world (Donald et al., 2010:80 and Schunk, 2004:286). To make the process more efficient, learners must be effectively engaged rather than just receiving or listening to information. Learners are able to develop their own understanding of the subject matter based on previous knowledge, and can correct any misconceptions they have. It has been shown that students in the constructivist environment demonstrated more enthusiasm and interest in the subject matter.
The teacher's role would be as facilitator, assisting students in focusing their questions, developing a strategy, helping to organise visits, and ensuring that the data collected and analysed meet standards of objectivity.

Learner-centred strategies pose a question to the learners, who then work together in small groups to discover one or more solutions (Yager, 1991). Learners play an active role in carrying out experiments and reaching their own consensus. Teachers assist the learners in developing new insights and connecting them with previous knowledge, but leave the discovery and discussion to the student groups (VAST, 1998). Questions are posed to the class and student teams work together to discuss and reach agreement on their answers, which are then shared with the entire class. Students are able to develop their own understanding of the subject matter based on previous knowledge, and can correct any misconceptions they have. Both teaching styles can lead to successful learning but it has been shown that learners in the learner-centred environment demonstrated more enthusiasm and interest in the subject matter. In fact, repeated research has found that teacher-centred lessons can be less or non-productive, and in some cases, detrimental to the students' learning process (Zoller, 2000). Many teachers

are hesitant to try the constructivist model, because it requires additional planning and a relaxation of the teacher-centred rules of the classroom (Scheurman, 1998).

Teachers often feel as though they are not doing their job if the learners are working together and actively discussing the material instead of busily taking notes (Sprague and Dede, 1999). Since any new idea is likely to be rejected unless teachers examine their own theoretical framework and develop their own justification for the change, it was suggested that additional quantitative evidence in support of constructivism might encourage more teachers to embrace this teaching style (Shymansky, 1992). Numerous studies have been completed to compare students' learning in traditional and constructivist classrooms. These studies generally based their conclusions on test or quiz scores and learner's comments or evaluations (Lord, 1997; Lord, 1999). The use of a quantitative analysis based on videotapes of the classrooms, which takes into account the actions of both students and teacher, should provide a new outlook on these teaching styles, as well as offering another means of objectively comparing the results.

Table 1: Comparison of teacher and learner centred strategies

Teacher centred	Learner centred
Teacher controls learning process	Learners control learning process
Instructional strategies are well-defined and selected based on the domain and type of learning goal	Learning is embedded in complex, problem-based real-world tasks
Learning environment is structured and sequenced properly.	Learning environment is open and flexible.
Goals and objectives are set by the designer or teacher.	Goals and objectives are set by the learner.
Assessment is aligned with the goals and objectives and conducted at the end of the instruction.	Assessment is a continuous and embedded in learning tasks
Cognitive process of knowledge acquisition is emphasised.	Multiple perspective and social negotiations are emphasised.

2.7. Teaching strategies used in probability

Jones et al. (2007) suggest that there are different viewpoints on how best to teach probability so that learners leaving school may be able to interpret in a wide range of situations. These views are based on different interpretations of probability. People think about probability in at least three different ways (classical, frequentist and subjective) and these views can be manifested in the teaching and learning process. Each of these interpretations has its advantages and disadvantages (Batanero et al., 2005). If teachers are to teach meaningful understanding of probability, it is important to acknowledge these interpretations and explore the connection between them and different contexts in which one or the other may be useful. The classical (theoretical) viewpoint assumes that it is possible to represent the sample space (all possible outcomes).

Teachers should have deep conceptual understanding of probability so that they can provide learners opportunities to develop conceptual understanding. In connection with this, Gal (2009) quotes Kazima and Adler's (2006b) idea by pointing out that teachers should not assume that activities that are not contextualized will enable learners to interpret, reflect upon and think critically about diverse probabilistic situations that may be encountered in real-life. Gal (2009) further explains that learning probability is not about spinning a spinner or rolling a dice, but it is for learners to interpret situations and make some predictions in the real life situations.

The focus of this study is on the exploration of teaching strategies used by grade 8 teachers to teach probability. These teaching strategies include teaching and learning approaches. I know there are many teaching strategies that are being used in mathematics but my main focus would be only on the strategies and approaches used in teaching and learning of probability. I am focusing on these strategies because I consider them to be important in teaching probability. For the purpose of this study, the cooperative learning approach was linked to the principle of effective teaching (arranging learners into groups), discussion as teaching and learning approach was linked to the use of correct mathematical language, and problem-based learning was viewed as a teaching and learning approach that is linked to both worthwhile mathematics tasks, and assessment. In addition to this, discussion is a teaching and

learning approach that is integral to cooperative learning and problem-based learning because in order for learners to interact with each other they need to carry out a discussion.

2.7.1. Cooperative

In this approach, learners are given an opportunity to talk to one another, work together helping each other as to how the work in front of them is being done. Learners question each other and provide the reasons why they arrive at a particular answer. Allowing learners to work as a team has the potential to make it easier for a teacher to facilitate the lesson. As the learners are working together they are learning from each other which is improving their level of thinking. Akinsola and Ifamuyiwa (2008) explain that cooperative learning is based on the fact that individuals depend on each other's effort to achieve the goal. Since learners are working as a team, each learner should have a role to play; scribe, presenter, leader and so forth. Every learner should be afforded a chance of getting a role which may be in the coming activity if not in the current one. But raising opinions is compulsory to every learner in all activities. Akinsola and Ifamuyiwa (2008, p.83) state that cooperative learning may serve the purpose of remediation, enrichment, tutoring and may assist with brainstorming.

Gauvain (2001) cited by Tuckman and Monetti (2011, p.311) argue that Vygotsky's perspective of constructivism states that learners learn better when they work in groups rather than when working alone. Green and Gredler (2002, p.54) attest that the theory of constructivism applies when learners actively construct their own knowledge rather than receive performed information transmitted by a teacher.

2.7.2. Discussion

Discussion is a teaching and learning approach that is integral to cooperative learning and problem based approach learning because, in order for learners to interact with each other, they need to carry out discussion. Learners also need to discuss the strategies of solving problems or tasks given to them. Discussion is also integral to other approaches which implies that it will always form part of other approaches (Kodisang, 2013).

2.7.3. Problem solving method

Kandermir and Gur (2009) agree with Kazima and Adler (2006b) who state that probability could be understood through the use of a problem solving method. This strategy is defined as a process in which open-ended questions are used. They emphasised that this strategy of problem-solving is needed for learners to understand the concept and the language used, as well as addressing the contradictions identified in learners' cultural knowledge and experience (Kazima & Adler, 2006b).

Learning that is gained from resolution of a problem is called problem-based learning by Hassan (2010). Killen (1998, p.33) as cited by Loggerenberg-Hattingh (2003, p.52) defines problem-based learning as a process of using existing knowledge in another situation to gain new knowledge.

2.8. Principles of effective teaching strategies

The following are the principles of effective teaching strategies (Antony & Walshaw, 2009).

Teacher knowledge: teacher's knowledge is the main component in order for learning to take place. A teacher should actually be fully equipped to meet the needs of learners, should teach with a passion so that learners would be inspired to, and perhaps, even become interested in becoming teachers themselves when they are adults.

Mathematical Language: teachers should use the correct mathematical language to learners, the correct terminology and also explain it to learners so that they understand the meaning.

Mathematical Communication: learners should consult as many textbooks as possible so they can be exposed to different ways of solving a problem. In mathematics they say there are many ways of killing a cat, meaning one problem can be solved in many ways, which can be justified but giving the same answer.

Building on Learners' thinking: lessons taught and activities developed should be built on learners' experiences and interests.

Assessment for Learning: informal assessment should aim at checking if what is taught is understood. The teacher asks questions and the learners respond verbally so that everyone can hear which also gives an opportunity to slow learners to catch up if somehow there was a setback. It also puts emphasis on the understanding of those learners who understood earlier and makes them feel good that they are following. Summative assessment should serve the purpose of checking that all that was taught throughout the year was understood. Summative assessment is important for taking the learner to the next grade.

Making Connections: learners should be able to use what they have learnt in their real life situation.

2.9. Conclusion

According to the literature reviewed, it appears that in order to apply the best teaching strategies, the teacher needs to understand the different ways in which students learn, and which learning strategy or method they prefer; the teacher should plan to use the appropriate strategy to ensure that the desired outcomes are reached. When focusing on the sample classroom it is noticeable that critics emphasise many faults and problems, but it is important to not focus on what is not working, but to rather focus on what can be learned. One needs to look carefully at what lies underneath to get a better understanding of how teaching strategies influence the learners' mathematics ability and performance.

In this chapter I have described the South African Curriculum that underpins my study and I have also looked at the background to mathematics. The literature review has outlined what other scholars say about the different strategies that can be used by the educator to facilitate interaction in the mathematics classroom. The chapter also dealt with strategies in general, teacher centred strategies, learner- centred strategies and strategies used in probability. In the next chapter the researcher engages with the methodology and research design of the study.

CHAPTER 3
RESEARCH METHODOLOGY

3.

3.1. Introduction

In chapter two, the literature reviewed was mostly about teaching strategies, the background to mathematics, teacher-centred strategies and learner centred strategies. This chapter gives further details on the South African curriculum and gives an account of the research plan that was followed in this study.

This chapter elaborates on the research methodology engaged in answering the questions for this study. A qualitative approach was employed and the research was positioned within the interpretive paradigm. The justification for selection of the methods of data collection and the research instruments used, and issues of trustworthiness are elucidated in this chapter. Ethical considerations and limitations of the study conclude the chapter. This study was on an exploration of teaching strategies used by mathematics teachers to teach probability in grade 8. In this chapter I outline the research methodology adopted in this study. Salkind (2012 p. 47) states that "research methods consist of a group of tools and techniques used to answer questions in a scientific manner".

In order to determine what teaching strategies are used in the grade 8 mathematics classroom, a case study approach was used. According to Bell (1999, p.10) "a case study approach is particularly appropriate for individual researchers because it gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale". The resources available for this study were limited, thus the researcher opted to use a case study and analysed the findings of the study.

In planning the case study it was necessary to keep the main focus in mind, to state the problem and basic questions clearly, to identify and implement an appropriate methodology, to design appropriate instruments to get the necessary information, to schedule the research activities, as well as to select suitable participants for this research. This chapter looks at the research design that was used and reports on the way that data was gathered and processed.

The researcher wanted to examine the strategies used in the grade 8 mathematics classroom which might help other teachers to improve their mathematics performance. The problem which was identified was the starting point for this study and the research questions determined the type of study to be followed. These research questions identified certain objectives that the researcher wanted to attain. The research questions for this study were:

- What are the teaching strategies used by teachers to teach probability?
- How are these strategies used to teach probability?

It became evident that concrete evidence needed to be found. The researcher had to explore teaching strategies used by grade 8 teachers in the mathematics classrooms and had to obtain feedback from the teachers on the effect of the teaching strategies used in their mathematics classrooms.

3.2. Research approach

Qualitative research was the approach for this study. Creswell (2008) describes qualitative research as "a type of research in which the researcher relies on the views of the participants, asks broad and general questions, and collects data consisting largely of words, analysis these words from themes and conduct the inquiry in a subjective manner." A qualitative research approach is a naturalistic and interpretive field of inquiry that draws on multiple methods of inquiry that is conducted in a naturalistic setting rather than a controlled one. Hardman and Hops (2008) argue that qualitative methods require a normal and regular place for participants to express their thoughts at will. The qualitative methods of research favour the interpretivist paradigm since the researcher believes that educational reality is socially constructed. The qualitative case study, within the interpretivist paradigm is therefore used in this study.

The qualitative approach draws on multiple methods such as narrative, grounded-theory studies or case studies where the researcher collects open-ended data. In this study, an exploration of teaching strategies used by grade 8 teachers to teach probability was carried out. To shed some light on teachers' strategies, it was necessary to obtain their personal views and beliefs regarding the teaching strategies.

The research approach was the key to determining how this study was conducted. The research approach guided the case study and how the data was collected and analysed. Kothari (2006) noted that the research design helps the researcher to adopt appropriate methods for collecting data and to use the correct techniques during analysis. According to Kothari (2006, p.33) the following should be considered from Brown and Dowling (1998, p.37) when making a decision regarding the type of research that should be followed, "If the major emphasis of the study is on discovery of ideas and insights the appropriate research approach is found to be exploratory while if the purpose of the study is on the accurate description of a situation the appropriate research design is descriptive." This study sought to gain insight into what teaching strategies were used; it sought to find out how effective these teaching strategies for teaching mathematics are. In the next section the research paradigm is discussed.

3.3. Research paradigm

Paradigm means "worldview" according to Creswell (2009, p.6). It is the way by which people interpret the world and embraces four terms (assumptions) namely, "ethics, epistemology, ontology and methodology" (Denzin & Lincoln, 2008, p. 245). These terms explain how people relate to and gain understanding about the world. In his work Maree (2007) defines ontology "as the study of nature and form of reality''. Epistemology as "the method of knowing the nature of reality'' and methodology as "the technique used by the researcher to discover reality".

The interpretive paradigm, which according to Cohen, Manion and Morrison (2011), examines the individual's personal judgement in relation to reality, was used in this study. The interpretive paradigm is based on the activities of human beings and the interpretations of their experiences. Check & Schutt (2012, p.15) describe the interpretive paradigm "as the belief that reality is socially constructed." The reason for the choice of the interpretive paradigm was that it assisted the researcher in identifying the kind of strategies used by mathematics teachers to teach probability to grade 8 learners. It also allowed the researcher to explore what strategies the participants use when presenting a lesson by engaging the participants in individual semi-structured

interviews. During the interview they specified why they preferred to use the identified strategies.

3.4. Location of the study

The study was conducted in the KwaZulu- Natal province, South Africa. The setting was in an urban area of KwaMashu and the schools were matched as institutions that were previously disadvantaged communities. The teachers and learners from participating schools are IsiZulu first language speakers and the participants are two grade 8 mathematics teachers, one from each school. The names of the schools are school A and school B and the study was conducted for only one year (2017). This study aims at exploring teaching strategies used by grade 8 mathematics teachers to teach probability. In the next section the population and sample are discussed as well as the sampling technique that was used.

3.5. Sampling

A sample is a part of a group that is used as a data source during research and whose understanding can be adopted to describe the whole cluster (Cohen et al., 2011). According to Neuman (2006, p. 219) “the primary purpose of qualitative sampling is to collect specific cases, events, or actions that can clarify and deepen understanding”. This resonates with Check and Schuft’s (2012) assertion that decisions about sampling in qualitative research are informed by the necessity to thoroughly consider in detail the participants, location and situations of the learners. A sample is a part of a group that is used as a data source during an investigation. Purposive sampling “is common in exploratory studies and much of qualitative research and it depends on the judgement of the researcher based on what unit will facilitate an investigation” (Adler & Clark, 2008, p. 121). Researchers use their discretion to choose participants and places for the research in order to explore the central issue of the study (Creswell, 2012).

The purposeful sampling technique was employed in this study because the two teachers from two different schools were selected to provide insight into the teaching of probability to grade 8 learners. Teachers are selected on the basis that they had to be teaching mathematics to grade 8. The background data relating to teaching experience and qualifications are also taken into consideration in selecting the participating

teachers. In this context, an experienced teacher was considered to be a teacher who had been teaching grade 8 mathematics for more than four years.

The study was carried out in schools during school hours. The participating teachers were in the same cluster being monitored by the same subject advisor giving them the same instruction and even the same teacher development programme. The participating teachers both had the same Annual Teaching Plan (ATP) provided by the KwaZulu-Natal Department of Education. The ATP sequentially outlines the topics to be covered, concepts and skills to be addressed, and the date on which the topic should be taught.

3.6. Data Gathering

Observation and interviews were used as the major means of collecting data. Data was collected in three phases: firstly was the pre-observation interview, then lesson observations and finally the post-observation interview. The interview done before the class observations was to understand how the teacher plans for his/her lessons. It was also meant to understand the teachers' role, beliefs and theoretical approach to the lessons. The second interview was done at the end of the observation lessons to reflect on what transpired during observation. Data was collected through an observation of the teachers' presentations of their lessons, and one-on-one semi-structured interviews with the teachers (tape recorders were used for easy transcription). The observations and interviews were used as data collection instruments.

The researcher spent two consecutive days (day 1 and day 2) in each school. The lesson observations were done during school hours and during mathematics period of the grade 8 class. The purpose of lesson observations was to gain more information on the teaching strategies used by grade 8 teachers in teaching probability. To explain this, two questions had to be answered. Firstly, how these teachers enforce the essential aspects of probability to enhance learners in order for them to understand what they are teaching and secondly, how teachers implement appropriate approaches and guiding principles in teaching probability. Each teacher was interviewed after having presented two successive lessons on probability.

The findings gathered during the observation were compared with those of the semi-structured interviews. I highlighted that the data gathered during the observation yielded the same data as from the semi-structured interviews.

After transcriptions were made, the data were given to the participants to confirm if the data was an accurate representation. The multi-methods were used for triangulation of data (Clark 2000) to achieve measures of trustworthiness (Krefting 1991).

3.7. Data analysis

Maree (2007) states that qualitative data analysis is usually based on an interpretive philosophy that is aimed at examining meaningful and symbolic content of qualitative data. "Qualitative data analysis involves organising, accounting for and explaining the data, in short making sense of data in terms of participants' definitions of the situation, noting patterns, themes, categories and regularities" (Cohen et al., 2011). Bogdan and Biklen (2007) describe data analysis as the process of arranging data, writing in codes and themes to develop a particular outcome. Drew, Hardman and Hosp (2008) agree that qualitative data analysis uses "words to isolate themes and identify trends". The data from this study was analysed carefully by obtaining, organising, coding and establishing themes and patterns that emerged from the multiple methods of collection.

Data was obtained from class observations and individual interviews of two participants. All interviews were audio-recorded which "frees the interviewer to concentrate on the topic" and allowed for the "words, tones, pauses" of the participants to be captured and played repeatedly as required (Kvale & Brinkmann, 2009, p. 179). The interviews were conducted at separate times and I started transcription during the interview phase. I listened and re-listened to the recorded interviews in order to obtain the words and phrases expressed. Data transcription is described by McMillan & Schumacher (2010, p. 371) as a way of translating data into a "format that will facilitate analysis".

The interviews were transcribed word for word and transcripts were prepared for each interview. I read the transcripts repeatedly to understand the participants' views in relation to answering the research questions of the study.

Coding refers to relating standardised remarks made in transcripts and grouping them together into sections (Adler & Clark, 2008). I adopted the "open-coding" approach where "concepts" are used to convey the information derived from the data collection methods (Flick, 2006, p. 297). Open-coding was accomplished using a "line-by-line and phrase by phrase" technique (Cohen et al., *2011*, p. 561). The participants' exploration of teaching strategies in relation to the research questions was categorised and coded. Interview transcripts were reviewed to derive this information.

Themes appear when similar segments or codes are merged together (Creswell, 2012). In this process, pointless and repeated codes were also eliminated to generate an accurate summary of the dataset. Roulston (2010, p. 150) describes thematic analysis in the qualitative approach as "sorting and classifying codes into groupings or clusters".

Miles and Huberman (1994, p. 11) write that "displaying coded data" will enhance the researcher's findings. After coding the transcripts and reflections of the participants, I displayed and organised the codes into themes according to Research Questions One, and Two.

Interpretation of qualitative data is firstly authenticating and then making inferences about it (Adler & Clark, 2008). After meticulously establishing the themes, I interpreted and made sense of the data based on how the "research questions were answered, personal reflections and literature reviewed" (Creswell, 2012, p. 257).

3.8. Trustworthiness (credibility, dependability, transferability)

Credibility- according to Lincon and Guba (2000) credibility refers to the idea of internal consistency, where the core issue is "how we ensure rigor in the research process and how we communicate to others that we have done so". To ensure credibility in this study, during semi-structured interviews, I had a tape recorder to record the interview to provide an account of how the process unfolded.

Dependability- dependability deals with the core issue that "the way in which a study is conducted should be consistent across time, and analysis techniques" (Gasson, 2004).

To ensure dependability in my study I ensured that the exact words of the participants were recorded so that the study was a reflection and representation of their voice.

Transferability- refers to the extent to which the reader is able to generalise the findings of a study to his or her own context and addresses the core issue of "how far a researcher may make claims for a general application of their theory" (Gasson, 2004). I fully described the context of the study in a manner that findings could be transferable to the same context.

3.9. Ethics

Ethics refers to "mutual trust, acceptance, co-operation, promises and well acceptable conventions and expectations between all parties involved in the research project" (Strydom, 2011). According to Kvale and Brinkmann (2009), the decency in terms of how human beings live, reason and behave is termed ethics. Neuman (2006) writes that ethical consideration requires researchers not to disturb the lives of people (respondents in a study) at the expense of advancing the body of knowledge. My study took into consideration a number of ethical issues in order to respect the dignity of all concerned.

3.9.1. Permission to conduct study

Wiersma and Jurs (2009, p. 436) explain that it is important to "obtain permission from the site's gatekeeper" when carrying out research in an educational environment. I applied for the ethical clearance from the Human and Social Sciences Ethics Committee of my university. This ethical clearance application was approved (see Appendix 1). Thereafter, I wrote letters to the principal and the teacher who is going to participate in the research. The permission was obtained from the sample school.

3.9.2. Informed consent from participants

"Consent involves the procedure by which an individual may choose whether or not to participate in a study" (Drew, Hardman, & Hosp, 2008, p. 57). Participants were informed that their participation was on a voluntary basis, and that they could withdraw from the study at any time without negative consequences. I prepared informed consent letters (see Appendix 2) for all the participants which they read and understood before participating in the study.

3.9.3. Anonymity and confidentiality

The locations and names of individuals who participate in research should not be disclosed in printed publications (McMillan & Schumacher, 2010). The details should be anonymised to maintain the participants' trust. Kvale and Brinkmann (2009, p. 72) concur, stating that "participants' right to privacy" must be guaranteed. Anonymity was assured in the letters to the participants. The settings and participants' details were not mentioned in my dissertation, and pseudonyms were used where necessary and appropriate. Codes were employed to protect the identities of the participants when writing the dissertation report. The participants were also not exposed to threat or duress during the study.

3.9.4. Data use and disposal

The research data will be stored for a minimum of five years in a secure location agreed to by my supervisor. This will be in the university at which I was registered during this study. Disposal of all transcripts will be accomplished by shredding using a shredding machine and by incineration of audio tapes after 5 years. This commitment was made in writing to the participants.

Before collecting the data, the participants were given both a verbal explanation and written outline information sheet of the research project's objectives and data collection methods. This was meant to emphasise and make clear that participation in the research project was voluntary and all reporting will keep participants' details anonymous. A separate consent form for teachers/principals to sign was attached to the written outline. All reporting from the study conformed to accepted ethical research practices on using pseudonyms for all names involved – of schools and teachers.

3.10. Limitation

Maxwell cited by Cohen (2011) states that "some participants may feel uncomfortable during interviews and formal verbal communication". The anticipated limitations to this study might be the withdrawal of participants. To overcome this limitation I requested permission to conduct research in more than 3 schools while I need only 2 sample schools. To overcome this limitation I will again encourage the participants and assure them that their input is valuable. I was given an audio recorder with a flat battery which

I overcame by having provided myself with two audio recorders and fortunately, the other recorder had a fully charged battery.

As a researcher, I am also a grade 8 mathematics teacher and also teach probability, therefore there is a risk of personal bias in the analysis of data. However as a researcher I avoided my bias to intrude the data and made sure that I used direct quotes or exact words of the participants so that the data represents their voices. I analysed only two lessons, which may be seen as too small to make broad conclusions.

3.11. Conclusion

In this chapter I have outlined the methodology used in the research project as well as research instruments used to collect data. A qualitative approach was adopted. I have also mentioned the ethical considerations that needed to be taken into account before collecting any empirical data in this research. In the next chapter, the results of the study are presented and discussed.

CHAPTER 4
DATA ANALYSIS

4.

4.1. Introduction

The aim of this chapter is to focus on the analysis of the data collected from classroom observations and the interviews. The sections in this chapter are organised in major themes as obtained in class observations and teacher interviews. The participants from two schools were interviewed and observed while teaching during their mathematics period. Pseudonyms were used for participants to preserve their anonymity and comply with ethical requirements. The two teachers are referred to as participant A and participant B. Data was collected through two lesson observations and two interviews (pre-interview and post interview) per teacher. The first part analyses data from lesson observation and part two analyses data from the interviews. The research questions guiding this study are:

1. What are the teaching strategies used by teachers to teach probability?
2. How are these strategies used to teach probability?

By grade 8 teachers teach probability and were observed applying strategies to teach probability. The phenomenon in this study is teaching strategies. Lesson observations were deliberately conducted to get an in-depth understanding of what strategies were used by the teachers when teaching probability.

4.2. Data collected during lesson observation

The information below presents the notes written during the lesson observations. After presenting the lesson observation notes, I present a simple interpretation of the lesson observations noting similarities and differences between teachers and between lessons.

4.2.1. Lesson 1

Participant A

Lesson 1 was an introductory lesson meant to define probability. The teacher wrote the definition of probability on the board and made an example of weather. He asked learners what it meant when it said there is 30% possibility of rain today. One learner

answered that it could rain and it could also not rain. He then asked learners what it means if he says there is 100% possibility of rain. Another learner was able to say it means it is definitely going to rain. He then asked if there was a 0% chance of rain then what does it mean. He explained to learners that there would be no rain. He then asked learners how to write 10% as a fraction, one learner said it is 10/100. He then converted % to a fraction. He asked learners to consider the case of 105% chance of rain. He then told learners that a chance cannot be more than 100%. He reminded learners that they said 10% is 10/100 now what is 100% as a fraction? One learner answered 100/100 =1. So, probability can never be more than one and starts from 0 to 1. He then asked learners how we write these definitions mathematically.

Learners were introduced to the probability formula. The letter P is used to indicate probability. Probability of an event to happen is equal to desirable outcomes over total number of outcomes: P (E) = desirable outcome / total number of outcomes; hence sometimes it is written as a fraction. So, the fraction comes from that mathematical statement.

He then had to explain to learners the meaning of an outcome. The teacher asked for and received a coin from learners. He reminded learners that a coin has two sides - head and tail. He asked learners if I spin a coin what might happen. How many different things can happen? Learners said two. The teacher explained that we call those outcomes which are tail and head. So, an outcome we can say is a result of a certain event. Spinning a coin is an event. He asked learners to give him an example of an event, and quickly told them that a concert is an event, tossing a coin is an event. He then asked learners to give him outcomes you get in tossing a coin, they were able to say it is a head and a tail. He asked learners the outcome we get after rolling a dice, learners said 6. What is a probability of getting 2 after rolling a dice? He said learners must give the answer as a fraction. One learner answered 1/6 and was able to explain that there is only one 2 out of 6 outcomes. He then asked the probability of getting a 0 after rolling a dice. One learner said 0. Probability then is 0/6. What is the probability of getting an even number? One learner said 3/6. He then said that it is a 50% chance. He then promised learners he would give them homework.

Participant B

Participant B quietly gave all learners a worksheet and started his lesson by asking learners, 'What are the chances of you passing? Learners said in unison, "*Mancane"* - meaning small. He then said if you study? Learners said, "*Maningi"* which means many. He then showed a dice to learners. He then asked what number will show if he threw the dice. Learners were saying different numbers. Before they could experiment with the throwing of the dice the teacher referred learners to the worksheet (page 192) that he had given them. The worksheet showed all 6 numbers that are found on the dice and the teacher explained to the learners that those are possible outcomes. The teacher then asked for chances of getting 1, learners were confused. He told them only 1 chance. The teacher himself threw the dice and only learners seated in front could see. The teacher was making learners guess what number was showing because learners who were at the back, who were unable to see could not give answers. The teacher referred learners to the worksheet again, this page gave an explanation of probability and learners were reading the explanation out loud. Probability is a chance or likelihood that something will happen. The teacher carried on to give learners an explanation of the event by saying since the dice landed on one that is an event. He mentioned that to describe probability you can use the word impossible. He gave examples "*inkomo ingazala umuntu". "Ilanga lingawa licoshwe zinkukhu".* The teacher then explained that impossible means 0. He explained even chance (equal opportunities). At the end of the lesson the teacher allowed learners to complete the assessment task given in the worksheet. The lesson was teacher-centred. Learners were given some classwork to do but still they were not doing it in groups and the teacher would quickly carry on with a lesson without letting learners finish the task and check if they were correct.

4.2.2. Lesson 2

Participant A

He started the 2nd lesson by asking learners the definition of probability of an event. No learner answered. He asked for an example of an event, one learner said a coin. The teacher continued to ask how many outcomes we get after rolling a dice, and the learners said 6. The teacher proceeded to ask the learners how we describe probability with regards to an event and outcomes. Probability of an event is equal to desired outcomes over total number of outcomes. The teacher asked the learners to pretend that

there was a spinner and one can only win if a spinner lands on black. What is the probability that one can get a jackpot? One learner said 1/6, which is the correct answer. The teacher then asked, “What is the probability that the spinner lands on red?” A learner answers and says that the probability is 2/6, which is correct. Why is there a probability of 2/6 for the spinner to get red? It is because there are only two red spots out of six.

The teacher then asks another question, “There are twenty-five (25) learners in a class, fifteen (15) of the learners are boys and the rest are girls. What is the probability that a learner is a boy?” A learner then responds and says it is 1/15. The teacher then explains that this is incorrect because 15 is only the total of boys and we need a probability of choosing a boy in the total of the class. To emphasise this point the teacher then goes back to the example of the spinner landing on red. The probability of the spinner landing on red was 2/6 because there are two (2) red spots in a total of six (6) spots. Therefore in the case of the probability of boys in the class room the correct answer is 15/25 because there are 15 boys in a total of 25 learners.

The following question was then asked, what is the probability that the learner is a girl? The teacher initiated this question by asking the total of girls in the classroom. The learners answered, “10!” The teacher then asked the probability that a learner is a girl. The learners are silent. The teacher then explains that the probability is 10/25. He then asks the simplest form of the fraction, which is 2/5.

Participant B

The teacher started a lesson by explaining the word certain which means it definitely is going to happen. The teacher then introduced percentage. The teacher asked learners what is a percent and learners said it is something over 100. He then explained impossible as 0%, unlikely as 25%, even as 50%, likely as 75% and certain as 100%. The teacher then told learners to do work on the handout he gave them. The teacher then introduced decimals 0, 5 = 1\2 =50%. Teacher asked about chances of getting even numbers from a dice. Learners were confused. This lesson was also teacher-centred. The teacher explained that by being able to pick even numbers or odd numbers from the sample is called an event. The teacher then began to ask learners what is a prime number since he noticed that learners are struggling with finding prime numbers.

Learners said a prime number is a number which has two factors. Learners were saying out loud prime numbers and they even mentioned 39. The teacher then said, “Check the probability of multiples of 5. How many factors of 24 do we have here, how many square numbers do we have here. How many cube numbers do we have?”

4.2.3. Principles of effective teaching strategies

Principles of effective teaching strategies comprise of the following: Teacher knowledge, mathematical language, mathematical communication, building on leaners’ thinking, assessment for learning and making connections**.**

Participant A

The teacher had the main component called knowledge but he actually lacked passion since he came with only a dice in his first lesson. The teacher did have mathematical knowledge, he was able to explain the language terms used in probability. Learners seemed to understand what the teacher was teaching because they were able to answer the questions asked. The teacher was able to catch learners’ attention because learners were all looking at him and also showed some interest. Learners were participating fully in the lesson. The teacher was even allowing learners to give sentences using the words: impossible, possible, unlikely, likely and certain. The learners were enjoying the lesson and the classroom ambiance was good. The teacher made sure that he was assessing learners during the lesson, which was helping slow learners if there was some setback. Most of the time, learners were answering in unison but the lesson was smoothly run by the teacher. The teacher would give one or two problems for learners to do individually and the teacher would walk around for checking. The learners would be doing their work with much enthusiasm.

Participant B

The teacher used correct mathematical language to learners and used repetition to reinforce the language. IsiZulu idioms were introduced to emphasise meaning, for example, impossible, then the learners would definitely be sure that this is something that would never happen. The teacher was able to make learners understand the language he was teaching on that day. The lesson was about learning the terms and the teacher allowed learners to answer him in Isizulu and would himself also switch to

Isizulu to make the lesson clearer to the learners. There was evidence that the teacher consulted many books because of the handouts he was giving to the learners which were a form of assessing the knowledge of the learners. In his lesson the teacher would give examples that are familiar to the learners so that he could build from unknown to the known.

4.2.4. Probability Strategies

Probability strategies comprise of: cooperative, discussion and problem based methods.

4.2.4.1. Participant A

The teacher allowed cooperative learning to take place although learners were not seated in groups but only in pairs. The interaction among learners was amazing. In some cases learners would not agree with each other and the teacher would come to give a solution. There was much discussion and questioning amongst the learners. Consequently the lesson was interesting indeed. The open ended questions were the most used strategy by the teacher. The teacher would ask questions and the answers would come from an individual but mostly from the whole class said in unison.

4.2.4.2. Participant B

Learners were seated in groups but there was little interaction taking place because the teacher did not allow that to happen. However the learners themselves would chance discussing with their friends since the situation of them sitting in a group was tempting them to do so. The teacher carried on with the lesson by always asking questions, which was his way of making sure that learners understood him. The teacher would discuss the terms with learners but would only allow discussion revolving around his views not giving learners opportunity to discuss among themselves. The learners participated fully in the lesson.

4.3. Data gathered from interviews

4.3.1. Importance of lesson preparation and workshops

The interview began with general questions which I posed to the teachers. One teacher had taught for 8 years while the second had 20 years of teaching experience. In response

to my questions on lesson preparation, the teachers reported that lesson preparation was an integral part of their teaching. One teacher said:

> Participant B: *One cannot go to a class without preparation, so I do prep every time I go to class.*

Both teachers agreed that lesson preparation should consider previous knowledge as well as previous exercises done in class. This is borne out in the following statements:

> Participant A: *A lesson preparation must include previous knowledge, learner participation and assessment.*
> Participant B: *One must go through previous exercises and do a lot of exercise before you present a lesson.*

Since I consider lesson preparation to be an important part of teaching strategies, I began the interview with questions on lesson preparation. I am of the view that teaching strategies need to be thought about even at the planning stage. Also related to teaching strategies (in my view) are mathematics workshops organised by the department. Hence, I asked a few questions on workshops.
In response to the issue of workshops attended, the participants said:

> Participant A: *We have attended CAPS workshops. We covered content at these workshops. I have also attended workshops on marking, and on how to set exam question paper.*
> Participant B: *Unfortunately, this year there was no mathematics grade 8 mathematics workshop that I have attended but previous years I have attended a lot of mathematics workshop and they are giving us a lot of information.*

It is a concern that workshops are not being held frequently. Participant A refers to attending CAPS workshops. CAPS was introduced in 2011. Does this mean since the introduction of CAPS there have been no workshops? Or could it be that participant A has not attended recent workshops? Either way, it is a concern that teachers are not being met regularly by mathematics subject specialists to update them. Participant B is

clearer in indicating that in 2017 (when the interviews were done) there were no mathematics workshops.

Notwithstanding the supposed frequency (or infrequency) of the workshops the participants indicated that they developed content knowledge at the workshops as well tips on how to teach a topic.

I probed the content of the workshop further and asked what specifically was covered in the workshops. Participant A said:

> *We cover content, methodology, and obviously marking, how to mark properly.*

Participant B also alluded to methodology of teaching when she said:

> *What I can say is that they cover almost all the aspects of mathematics especially the teaching methods.*

It is quite promising that one of the aspects covered in the workshops is how to teach different sections of mathematics.

As I mentioned earlier, these were preliminary questions to break the ice for more in depth questions on teaching strategies. In the next section of the chapter, I will present the data generated on teaching strategies.

4.3.2. Teaching strategies

In the interview I asked some general questions on teaching strategies. In this section I present data related to general teaching strategies.

4.3.2.1. General teaching strategies

Teachers were asked which teaching strategies they were familiar with. Their response was as follows:

> Participant A: *There is nothing special I just use previous exam question papers and do revision, I got my own revision material and a lot of stuff that I use for revision.*
> Participant B: *As an old person I use previous exam question papers.*

It is an area for concern that the teachers rely only on examination papers to teach. They were unable to mention even one teaching strategy. Participant B says that he is too old to know teaching strategies. This goes against the norms and standards of teachers being lifelong learners.

4.3.2.2. Strategies for teaching mathematics

Mathematics is different from other subjects in the sense that it demands specific skills from learners and therefore it has its own teaching strategies. The interest of the study is on exploring strategies used by teachers of mathematics. The question asked was what strategy is useful to them in teaching mathematics. The response was as follows:

> Participant A: *I think the important thing in math is to let learners do more work than you. I'm tired of teachers trying to teach too much and learners are kept idle doing nothing so for me the best thing is always to get learners active.*

Participant A said that he let learners be actively involved by giving them more work, which is a strategy that is also recommended in mathematics because mathematics needs a lot of practice. By letting learners do more work it is encouraging them to work and construct knowledge on their own. Participant B also alluded to planning when he said:

> *I think the most of teaching strategies that are useful to go and plan your working plan your lesson properly and you must bring you must understand about what problems of your kids in class and that is works a lot planning.*

According to participant B, proper planning is the most important aspect in selecting strategies and the type of learners must be considered. Milkova (2012) states that a lesson plan is a map of what learners should learn and how it will be performed

efficiently. Therefore a variety of strategies to accommodate all learners must be adopted.

4.3.3. Teaching strategies used in probability

Since planning is a priority to the teachers I then asked the questions regarding the importance of probability and strategies used specifically for probability.

4.3.3.1. Importance of probability

In the interview I asked some questions regarding the importance of probability. Their response was as follows:

> Participant A: *It's important but not for all learners because if you look learners that would be doing engineering they have nothing to do with probability after school so but on average it's alright.*
> Participant B: *It is very important for the learners so that they understand what is really happening what are the chances for them to do anything within the world or whatever around them to know about chances.*

While both teachers view probability as an important topic, one teacher alluded that it is important but not for all learners. Participant B sees probability as important for learners to prepare them for outside world.

I further probed as to which aspects in teaching probability they consider essential. The response was as follows:

> Participant A: *Probability is a practical topic, so learners need to be hands-on with the concept of probability.*

When participant A said learners should be hands on, he was continuing with the previous point when he said learners must be given more work so that they can be actively involved. Probability is effectively learnt by getting learners work practically using some dice, playing cards, coins etc.:

> Participant B: *It's very essential to have the preparation have the basic like I said teaching of surds they must understand what the union is, what is the intersection, what is when something is not within the set and everything.*

The consideration of previous chapters to be learnt before probability is a concern to participant B. He mentioned that surds should already have been taught before probability. Surds is where unions and intersections are being introduced.

The teachers were then asked to describe the level of emphasis that CAPS placed on probability. The response was as follows:

> Participant A: *There is no special emphasis on probability because if you look at probability it's like 5% of the exam so learners that are very good in math but not good in probability can still get A plus in probability so it's a very small section of math in grade 12 specifically. Ya in grade 8.*
> Participant B: *I think the emphasis of CAPS to probability the continuity of this how do they find this when they attend the university probability is there, so they must have basic they must have*

The curriculum emphasises the use of the experimental approach in the teaching of probability. It also emphasises that doing experiments with a coin is easier than with a dice because the coin has two possible outcome (head or tail) but a dice has six outcomes (numbers 1 to 6). Both participants could not estimate the level of emphasis that CAPS placed on probability.

4.3.3.2. Teaching strategies

During the interview the teachers were asked which teaching strategies they use in teaching probability. Learners experience probability in their everyday life activities without understanding the actual mathematics concept on which such activities are based. During the interview the teachers were asked which teaching strategies they use in teaching probability. The response was as follows:

> Participant A: *As I said before its practical you need to get for example a die or pack of cards so learners can be able to do what you are saying they must do and they must see what you call experimental probability. They need to experiment; they need to see the number of cards; what happens if you roll a dice; what happens if you pick a blue.*

In support of this statement participant B also highlighted as follows:

> *I used to be practical - bring a lot of practical things; leave away the theory part; bringing cards some balloons whatever colors everything that is practical to them so that they can understand it clearly.*

Based on these statement both teachers understand that probability is about experimental learning. In this case learners are expected to perform experiments after which they had to list the outcome of the results and record them. I then proceeded to ask why these strategies are important.

> Participant A: *Because it's these strategies are important because probability as I said is a practical topic, so learners need to practice it.*

Participant A suggested that probability is a practical topic and carried on to say letting learners practice is important:

> Participant B: *So that they understand it more clearly.*

The responses for both participants complemented each other as participant B was completing the statement of participant A, by saying these strategies are important so that learners would understand clearly. Taylor (2008) highlights that if sufficient resources could be allocated, a huge improvement is possible in South African schools.

4.3.3.3. Use of technology

I then wanted to find out if they use technology in teaching probability and why. The response was as follows:

Participant A: *Yes, I do, it changes the environment of the class*.

The use of technology in the classroom make things easy in fact it saves time and the learners themselves learn how to use it:

Participant B: *Not so far. That* why *I said I'm an old person I use practical things.*

Participant B does not use technology and he seems to be obviously not prepared to ever use it as he kept on saying he is an old person. It is however a disadvantage to the learners he teaches.

The teachers were then asked of strengths of using technology in teaching probability:

Participant A*: I don't think is any strength it just that learners get excited when you bring something different from normal talking and writing on the board.*

The teacher is not sure of any strengths in using technology but to change the environment:

Participant B: *Technology no I don't use.*

There is no strength to be mentioned by participant B since he does not use technology at all.
I then asked the weaknesses (challenges) of using technology in teaching probability. The response was as follows:

Participant A: *Technology sometimes can confuse you if you have no light at school if machine that you are using break and you find that you are not able to use technology, so it got some disadvantages.*

Participant A says his weakness would be when the machine is not working or when the electricity is off. Participant A is evidence of teachers who have no problem with technology.

> Participant B: *Very they will just look at that there is a feeling, or they can they don't understand it exactly what is really happening whatever.*

Participant B believes that his lack of using technology is not wrong, because, in his view, even learners themselves would not understand it.

4.3.3.4. Use of different strategies

Then the next question in the interview was to find out to what extent the teachers consider the use of different strategies to be important.

> Participant A: *Very important because it exposes learners to different environment and different strategies and they get to understand concept easy*
> Participant B: *It is very important to use different strategies may the one that one is using if you say you are sticking to one practical technique may be one of the kids that doesn't understand that, so you must go all around the techniques so that everyone can understand in the class.*

Both teachers see a variety of strategies as important. According to their statements it is because it accommodates all learners since learners do not all learn in the same way.
Teachers were then asked how they check learners' understanding during the presentation of their lesson. The response was as follows:

> Participant A: *I teach for a very short time the learners do more work, so I do a short presentation and I give an assessment short presentation and I give an assessment*
> Participant B: *Maybe I do some assessment after each lesson that I conduct I give them some exercises, I check with them, I go to them within the class so that I can see they follow whatever.*

Both teachers said they give some work while they are still in class and also check if learners are on the right track.

4.4. Conclusion

This chapter provided an analysis of the data collected through observation of lessons and semi-structured interviews. I started by analysing the observation of lessons and then the semi-structured interviews. I formulated themes based on the data collected. I then discussed these themes from what transpired from the data collected. The next and final chapter will focus on the findings and interpretation of findings and recommendation.

CHAPTER FIVE

5. SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1. Introduction.

The study explored teaching strategies used by grade 8 teachers to teach probability. The intention of the study was to identify the strategies that mathematics teachers use in teaching probability. Chapter four presented findings and subsequently discusses the significance of the key findings from lesson observation and interviews followed by the recommendations and conclusion of the study. The recommendations and conclusion are informed by the discussed findings. The findings are discussed in relation to the research questions. The two research questions were as follows:

- What are the teaching strategies used by teachers to teach probability?
- How are these strategies used to teach probability?

To determine whether the research questions have been answered, they are re-visited in this chapter.

5.2. The use of different strategies.

During the interview session both participants pointed out that using different strategies is important to accommodate all learners. The researcher observed that the participants were using both teacher-centred strategies and learner-centred strategies during their lesson presentations. This confirms what Brown, Lake, & Matters (2009) say that teacher-centred and learner-centred orientations may be parallel emphases, meaning that teachers can simultaneously believe in being both teacher-centric and learner-centric. In both participants' classes learners were actively involved in the sense that learners were answering questions. Learners were observed covertly taking chances of discussing while the teacher was in front. The participants would sometimes let learners repeat the statement they are saying. Although the participants never had enough resources or teaching aids the lessons were effective and could meet the participants' goals. The participants could also understand the needs of their learners, and frequently used isiZulu to accommodate all learners and to make sure that at least no one is left behind. This is in keeping with Smith (2016) where he says teaching is the process of attending

to peoples' needs, experiences and feelings and making specific interventions to help them learn particular things.

The most dominant strategies the participants were using were teacher-centred which was accompanied by so many components which in turn benefited both teachers and learners. The components that accompanied teacher-centred strategies were code-switching, and letting learners repeat after them. The study revealed that it is not always true that teacher-centred strategies make learners become passive. This contradicts what Zoller (2000) has said when he says that teacher-centred lessons may be less or non-productive, and in some cases, detrimental to the students' learning process.

Teachers made all the decisions concerning the curriculum, teaching methods, and the different forms of assessment. However it is interesting that both participants A and B also used learner-centred strategies in their lesson presentation. Teacher-centred and learner-centred strategies complemented each other extremely well. For both participants much time was used for teacher-centred strategies. If there was a chance for learners to work in pairs or in groups, participants would rush the learners for feedback.

The findings indicate that the two teachers in this study use an instructional (direct) method to teach. After the lesson presentation the participants realised that they should have brought or introduced different strategies to learners. The study exposed that the two teachers in the study favoured the chalk and a board strategy and did not allow learners to get actively involved in the lesson. The subjects are actually taught through the medium of English; however it was understandable when the teachers switched to explain things in Zulu. This suggests that teachers are aware of language challenges of learners. Code-switching to another language should be at least minimised and learners should be encouraged to engage with the language of instruction. The study revealed that the teachers would teach standing in front of the learners for the whole period. The only learners that may pay full attention would be those seated in front, those at the back could not even see what was happening when the teacher was rolling a dice. Participant B did give learners some work to do individually but participant B would not walk around to check if they doing it. In a few minutes he was expecting learners to give answers in the form of raising hands.

5.3. The lesson plan

The findings of the study revealed that both teachers do not do lesson plans. When teachers were asked in the pre-interview about lesson plans, they both claimed that lesson plan was an important tool to use. During the post- interview when teachers were asked about how they can improve their lesson in the future, they mentioned many things that they should have brought to the lesson and that in future they were going to bring them. However, lack of good planning resulted in lessons that were ineffective.

5.4. Previous knowledge of learners

The findings indicated that previous knowledge from learners is of vital importance as it gives an indication to the teachers as to where to start the lesson. Before they started their second lesson presentation, both participants started by asking learners about the things they had learnt the previous day. The homework that the learners were given also helped in checking the previous knowledge of learners and also assisted those learners who are slow learners.

5.5. The lesson outcome

The findings indicated that the strategies used by participants were mostly effective. It was noted that teachers were identifying the same learners to give them answers. In some instances the questions were asked to the whole class and would be answered by all learners in unison and there were no opportunities at all for learners to ask questions. The study revealed that there was some interaction among the learners, but the whole time the teacher was the centre of attention by doing a lot of talking. This is in keeping with Stofflet (1998) when he says learners are expected to blindly accept the information they are given without questioning the instructor. Participant B on the first lesson did give a task for learners to do in class but he never checked it. At the end of the lesson he gave learners homework. By giving learners homework will help teachers identify the effectiveness of their teaching strategies.

5.6. Challenges encountered in teaching probability

Participant A used an overhead projector in his second lesson presentation. The lesson was smoothly run by the participant and learners were participating well and the lesson

was moving faster than the previous one. On that day the lesson was conducted in the laboratory where the overhead projector, shared by the whole school was kept. The challenge was that another teacher also wanted the overhead projector for her lesson.

5.7. Summary of findings

The findings revealed that teachers are aware of different strategies but opt to mostly use teacher-centred strategies. Although during the interviews the teachers mentioned that they use different kind of strategies in their lesson presentation the strategies they used were limited. In participant A's classroom learners were arranged in groups and learners would eventually interact regardless of the instruction from their teacher. The study revealed that learner-centred strategies were coupled with teacher-centred strategies. In participant B's classroom learners were seated in pairs facing the front where their teacher was standing. The learners in Participant A's class were also interacting as they were sitting in pairs without the instruction from their teacher. The study revealed that the culture of both classes from different schools were the same. Learners were free to interact and the teachers would understand that they should do so because they would allow that short amount of time for them to interact.

The study also revealed that though many learners in both classes were being challenged by probability content the persistence of both participants of code switching to isiZulu overcame it. The examples the participants were using were good as learners remembered them before they could tackle a problem. The study revealed that the resources required for probability were limited.

5.8. Recommendations

(a) It is recommended that teachers be encouraged to use technology as another strategy to teach. It is suggested that the Department of Education should offer some training in technology.

(b) It is recommended that teachers get proper training regarding learner-centred strategies from the Department of Education. Teachers will gain new skills and different ways of teaching while learners will acquire the skills needed in the modern world to

interact with and work independently. It is also recommended that teachers should continuously capacitate themselves regarding mathematics and be lifelong learners.

(c) It is recommended that practical topics be consolidated, and relevant teaching strategies be attached and monitored for implementation. It is further recommended that mathematics teachers should be engaged and assisted on teaching strategies and learning activities that will help in achieving the desired goals.

(d) The study recommended that the Department of Education should offer some training in technology.

5.8. Conclusion

In this chapter the researcher sought to answer the research questions which are:

- What are the teaching strategies used by teachers to teach probability?
- How are these strategies used to teach probability?

This chapter presented the interpretation of findings and recommendations from data collected, conclusions were drawn and recommendations were made from the study. The aim of the study was to explore teaching strategies used by grade 8 teachers to teach probability. The teachers showed knowledge of different teaching strategies but lack proper implementation of other strategies

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education

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Mrs BT Khathi
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Dear Mrs Khathi

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"EXPLORING TEACHING STRATEGIES USED BY GRADE 8 MATHEMATICS TEACHERS TEACHING PROBABILITY"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 03 July 2017 to 09 July 2020.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Nqabakazulu High School
Mzuvele High School

Dr. EV Nzama
Head of Department: Education
Date: 05/07/2017

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Information Sheet and Consent to Participate research

Dear Ms

My name is Bonisile Teressa Khathi from University of KwaZulu-Natal (Edgewood Campus) in South Africa. I am a coursework Master's degree candidate. My email address is boni.khathi@yahoo.com. My contact number is 0768333850 and I reside at KwaMashu in Durban.

You are being requested to consider participating in a study that involves research about Exploring teaching strategies used by grade 8 mathematics teachers in teaching probability. The aim of this research is to gain an in depth understanding about the explored phenomenon of teacher strategies. The study is expected to enrol one teacher per school. It will involve the following procedures: observation and interviewing the participant for the acquisition of data. The duration of your participation if you choose to enrol and remain in the study is expected to be two months. The study is funded by myself as a master's student due to lack of sponsorship.

The study may involve the following discomforts, lengthily interview and observation that may consume time. We hope that the study will create the following benefits: develop mathematics teachers' knowledge about teacher's practices and sufficient understanding of probability.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number……..).

In the event of any problems or concerns/questions you may contact the researcher at 0768333850 and e-mail boni.khathi@yahoo.com or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows: Research Office,

Westville Campus,
Govan Mbeki Building,
Private Bag x 54001,
Durban, 4000, KwaZulu-Natal,
SOUTH AFRICA 04557,
Fax 27 31 2604609, Email: HSSREC@ukzn.ac.za

You may also feel free at any time to contact my supervisor at 0312603422 and/or email maharajhlr@ukzn.ac.za

Cell: 0768333850
E-mail boni.khathi@yahoo.com or victor.khathi@live.co.za
My supervisor is Dr Maharajh who is a discipline co-ordinator, Curriculum Studies, School of Education, Edgewood College, University of KwaZulu-Natal, (Tel) 0312603422. (cell) 0724356968, Email maharajhlr@ukzn.ac.za

You may also contact the Research office through: Ximba Phumelele HSSREC Research Office, Tel: 0312603587, Email: ximba@ukzn.ac.za
Thank you in advance for your contribution in this project.

DECLARATION
I……
…… (Full names of the school principal) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent for the school and teacher to participate in the research project.

……
…….
SIGNATURE OF PRINCIPAL DATE

SCHOOL STAMP

Angela Bryan & Associates

6 La Vigna
Plantations
47 Shongweni Road
Hillcrest

`

Date: 30 December 2018

To whom it may concern

This is to certify that the Master's Dissertation: Exploring Teaching Strategies Used by Grade 8 Mathematics Teachers to Teach Probability written by Bonisile Teressa Khathi has been edited by me for language.

Please contact me should you require any further information.

Kind Regards

Angela Bryan

angelakirbybryan@gmail.com

0832983312

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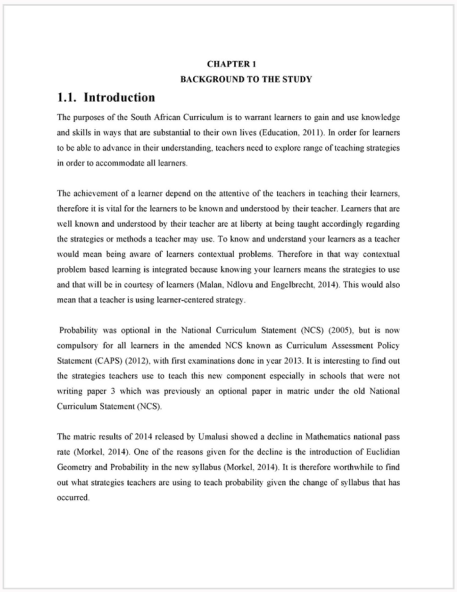

CHAPTER 1

BACKGROUND TO THE STUDY

1.1. Introduction

The purposes of the South African Curriculum is to warrant learners to gain and use knowledge and skills in ways that are substantial to their own lives (Education, 2011). In order for learners to be able to advance in their understanding, teachers need to explore range of teaching strategies in order to accommodate all learners.

The achievement of a learner depend on the attentive of the teachers in teaching their learners, therefore it is vital for the learners to be known and understood by their teacher. Learners that are well known and understood by their teacher are at liberty at being taught accordingly regarding the strategies or methods a teacher may use. To know and understand your learners as a teacher would mean being aware of learners contextual problems. Therefore in that way contextual problem based learning is integrated because knowing your learners means the strategies to use and that will be in courtesy of learners (Malan, Ndlovu and Engelbrecht, 2014). This would also mean that a teacher is using learner-centered strategy.

Probability was optional in the National Curriculum Statement (NCS) (2005), but is now compulsory for all learners in the amended NCS known as Curriculum Assessment Policy Statement (CAPS) (2012), with first examinations done in year 2013. It is interesting to find out the strategies teachers use to teach this new component especially in schools that were not writing paper 3 which was previously an optional paper in matric under the old National Curriculum Statement (NCS).

The matric results of 2014 released by Umalusi showed a decline in Mathematics national pass rate (Morkel, 2014). One of the reasons given for the decline is the introduction of Euclidian Geometry and Probability in the new syllabus (Morkel, 2014). It is therefore worthwhile to find out what strategies teachers are using to teach probability given the change of syllabus that has occurred.

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

8 August 2017

Mrs Bonisile Teressa Khathi 981225941
School of Education
Edgewood Campus

Dear Mrs Khathi

Protocol reference number: HSS/1065/017M
Project title: Exploring teaching strategies used by Grade 8 Mathematics teachers in teaching Probability

Full Approval – Expedited Application

In response to your application received 11 July 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....

Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr Lokesh Maharajh
cc. Academic Leader Research: Dr SB Khoza
cc. School Administrator: Ms Tyzer Khumalo

Humanities & Social Sciences Research Ethics Committee
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