AN EXAMINATION OF FACTORS AFFECTING GRADE 9 LEARNERS' PERFORMANCE IN MATHEMATICS IN KING WILLIAM'S TOWN EDUCATION DISTRICT

by

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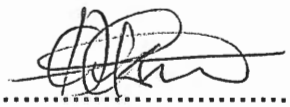
DECLARATION

I, George Adom, do hereby declare that this dissertation is the result of my investigation and research and that this has not been submitted in part or full for any degree at this or any other university.



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ABSTRACT

Successive governments of post-apartheid South Africa have sought to address the canker of the falling standard of education in the various districts. However, these efforts by governments, the Department of Education, and stakeholders have not yielded the desired results in mathematics in the district of King William's Town which still remains one of the poorest performing districts in mathematics. Therefore, this study investigates factors that affect grade 9 learners' performance in mathematics in selected schools within the King William's Town education district. Three hundred and sixty (360) grade 9 learners and five educators were drawn through a Multiple Sampling Techniques of stratified, simple random and purposive method. The researcher used the mixed method research approach. The instruments used in collecting data were a structured questionnaire, semi-structured interviews and observations to elicit information from the learners and educators teaching grade 9 mathematics. Information gathered from the learners and educators included: biographical information, factors affecting teaching and learning of mathematics and suggestions. The quantitative data were analysed using descriptive and inferential statistics while the thematic approach of coding, sorting, and categorisation were used to analyse qualitative data. Recommendations were made to the various stakeholders such as the government, the Department of Education, principals, educators, learners and caregivers. These recommendations will therefore help in finding lasting solutions to grade 9 learners' problems with learning mathematics.

Key words: Educators, Factors affecting mathematics, King William's Town education district, Learners, Mathematics

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The high level of youth unemployment in South Africa in general and in the King William's Town district in particular is closely linked to the quality of schooling especially in numeracy and literacy Centre for Development and Enterprise (CDE, 2013). According to the Human Sciences Research Council (HSRC), South Africa's growth is stifled by a severe skills shortage, particularly in the fields of science, technology, engineering, mathematics and accounting, and this gap has largely been blamed on the poor quality of the educational system (Ann, 2011). Mathematics is a pre-requirement for entering into these careers to enable learners understand the content of the various subjects in these disciplines.

Successive governments of post-apartheid South African have sought to address the backlog of deficiency of learners' mathematics by introducing various pro-active measures. The government has organized a series of training and workshops for teachers handling mathematics in order to sharpen their skills and tap into modern learners' natural affinity for all things technological. In parallel to the teacher training, Govan Mbeki Mathematical Development Unit (GMMDU) is also running incubator schools for more than 400 selected learners from under-resourced schools. Learners receive Android tablets which they are trained to use as a "personal tutor" after school hours (GMMDU, 2013). The government also introduced the Annual National Assessment (ANA) to measure progress in learners' achievement in literacy and numeracy and also to provide valuable feedback to schools, teachers, learners and parents Department of Education (DoE, 2011). With all these measures put in place by government to improve the performance of learners' mathematics, only little improvements have been documented.

1.2 BACKGROUND TO THE STUDY

There is a major concern globally about the performance of learners in mathematics. Through international cooperation and partnerships, the United Nations Organization

for Education, Science and Culture (UNESCO) organizes activities, especially in developing countries, to promote capacity-building for research and advanced training in mathematics and mathematics education and, in general, to enhance public understanding and appreciation of the importance of mathematics in society and daily life. UNESCO supports initiatives that address the lack of interest by students in mathematics, and those that upgrade teachers on their knowledge of new developments in mathematics and its significance to society and daily life. Within this context, partnerships are being strengthened with the International Commission for Mathematical Instruction (ICMI), regional mathematical societies, universities, and research institutes (UNESCO, 2014).

"Choose mathematics," a Norwegian scholar has advised students "because you will meet it more and more in the future. Mathematics becomes more and more important in all areas of work and scholarship. There will be more mathematics at work, so you will need more mathematics at school" (Hanushek & Woessmann, 2008). The American Diploma Project agrees with this assessment, estimating that "in 62 percent of American jobs over the next 10 years, entry-level workers will need to be proficient in algebra, geometry, data interpretation, probability and statistics"(cited in Friedman, 2007:302).

Hanushek & Woessmann (2008) assert that there is also a technical reason for focusing our analysis on mathematics. This subject is particularly well suited to rigorous comparisons across countries and cultures. There is a fairly clear international consensus on the mathematical concepts and techniques that need to be mastered and on the order in which those concepts should be introduced into the curriculum. The knowledge to be learned remains the same regardless of the dominant language spoken in a culture.

The Program for International Student Assessment (PISA, 2012) conducted a test with about 510,000 students across the globe in 65 countries on mathematics, science and reading. This test cycle had a particular focus on mathematics. The mean score for mathematics was 494, while the mean score in reading and science was 496 and 501 respectively. The results showed distinct groups of high-performers in mathematics. The East Asia countries of Shanghai and China scored the best result of 613. The United Kingdom, Ireland, Australia and New Zealand had an

average score of 494, with the USA trailing this group at 481. On average, boys scored better than girls in mathematics, girls scored better than boys in reading and the two sexes had quite similar scores in science (PISA, 2012).

The National Assessment Governing Board (NAGB, 2005) conducted a test with representative samples of grade 8 learners in public and private schools in each of the 50 states, in ten large public school districts in the U.S. in math, science, and reading. NAGB observed that only 6.04 percent of the students in the U.S. in 8th grade in 2005 scored at the advanced level in maths. Trends in International Math and Science Study (TIMSS, 2007) also administered an international test to students throughout the world; this test appeared to have set a standard very similar to NAEP in 2005. As a result, only six percent of U.S. 8th graders scored at the advanced level on that test as well (Loveless, 2008).

The International Mathematical Union (IMU, 2009) released a report on the disparities in mathematical development in Africa. According to IMU, North Africa is a relatively advanced region in mathematics, partly due to governments' broad commitment to research and education at all levels and sustained support from nearby Southern Europe. Among African countries, Egypt has a uniquely strong mathematical community. Francophone Africa, reflecting its colonial past, with continued support from the world-wide Francophonie, is relatively advanced in secondary and tertiary mathematics, but its strength in pure mathematics is not matched by activities in applied fields. The Anglophone countries of East Africa are generally weaker in pure mathematics, with most emphasis directed towards applied fields (IMU, 2009).

The West Africa Secondary School Certificate Examination (WASSCE) asserts that over ninety thousand WASSCE candidates failed mathematics and science. (WASSCE, 2015). Also there have been overwhelming concerns from government and stake-holders over the poor performance of students in mathematics and science as reflected by recent results released by the West African Examination Council (WAEC, 2015).

The revelations by WAEC follows the recent report by the Organisation for Economic Cooperation and Development (OECD) which ranked Ghana last among 76 other

countries regarding the performance of students in mathematics and science (OECD, 2015).

Kenya has a relatively strong bachelor's programme in pure mathematics, applied mathematics, statistics and computer science. However, the poor performance in mathematics in primary and secondary schools remains an issue of great concern (Aduda, 2003).

According to the National Examination Council of Tanzania (NECTA, 2007), it shows that the state of mathematics in Tanzania is poor, especially at the primary and secondary school levels. The World Economic Forum (WEF, 2014) ranked South Africa's mathematics and science education second-last in the world ahead of only Yemen. Some of the smaller countries in Southern Africa offer exciting models of collaboration, primarily Tanzania, Botswana, and Zimbabwe, as well as the other countries of the Southern African Development Community (SADC). Some South African schools, notably private schools and formerly all-white universities, have achieved relative strength in mathematics. Its capacity nationwide, however, is very low.

IMU (2009) also observed that in most African countries mathematical development is limited by the low numbers of secondary school teachers and mathematicians at the masters and PhD levels. With few professors to train the next generation of leaders in the field, countries cannot meet the growing demand for mathematicians with advanced, up-to-date training.

Van der Walt, Maree & Ellis (2008:490) indicated that "researchers agree that, the subject matter knowledge of the majority of learners in South Africa is parlous". They further argued that South African learners experience problems relating to their limited technical vocabulary of mathematics. The South African Human Sciences Research Council (HSRC) conducted studies in 1995, 1999 and 2003 to assess learners at grade 8 level in mathematics and science. Among the six African countries, (Egypt, Tunisia, Ghana, Botswana, Morocco & South Africa) that participated in the Trends in International Mathematics and Science Study, South Africa had the lowest score in science and mathematics even though grade 9 learners participated for South Africa with the excuse that the questions were too tough for their grade 8 learners (TIMSS, 2003).

The CDE (2011) (cited among other data collected in 2007) showed that the majority of grade 6 teachers in South Africa cannot answer a question that their learners ought to answer based on the grade 6 curriculum. The CDE report reiterates that the teaching of mathematics in South Africa schools is among the worst in the world. A study conducted by UNICEF (2005) indicated that South African learners ranked fourth with an average literacy score of 48.1% and rated last with respect to numeracy, scoring at 30.0%.

In 2011, TIMSS showed that South African learners have the lowest performance among all 21 middle-income countries that participated in the study. Reddy (2004:1) explains that there is no single cause of South Africa's poor and diverse performance in mathematics. Preliminary explanations could be linked to multiple, complex and connected sets of issues, including the following: issues of poverty, resources and infrastructure of schools, low teacher qualifications, and poor learning cultures in schools. Language proficiency is a contributory factor but the issues of conceptual and cognitive demands placed on students [illegible]ooms seem to be significant.

Van der Walt et al. (2008) and Ndlovu (2011) also argues that the poor performance of South African learners in mathematics can be likened to lack of appropriate learner support materials, poor socio-economic background of learners, medium of instruction, lack of motivation, poor quality of teachers and inadequate study orientation. The results of the South African National Study in Mathematics and Science (Reddy, 2004) shows that there is a difference in performance among provinces, with the Western Cape, Northern Cape and Gauteng being the three highest performers. The three lowest performers were KwaZulu Natal, Eastern Cape and Limpopo. Analysis of learners' performance reflects that learners in the former white schools have the highest scores whereas learners in the African schools have the lowest scores.

King William's Town is the second most populous city in the Buffalo City Municipality, with a population near 100,000 inhabitants (Eastern Cape Census, 2011). King William's Town education district has about 416 public schools made up of combined schools, intermediate schools, primary schools and secondary schools in all suburbs and townships (ECDoE, 2015). However, these educational institutions have not been able to mitigate the major challenges facing the district. Education is widely

acknowledged as key to the development of every nation. However, this expectation is proving elusive in South Africa due to the fallen standard of education. This decline in performance is notable in subjects like mathematics and science (ECDoE, 2001). Out of the 81 education districts in the country, the 10 districts that performed below 60% in the 2012 matric examination were all in the Eastern Cape (Eastern Cape Social Economic Consultative (ECSECC, 2015). This is shown in the table below.

Table 1.1: Districts that performed below 60% in the 2012 matric examination

Districts	Percentages
Fort Beaufort	44,7
Mt Frere	49,6
Qumbu	49,1
Butterworth	53,9
Dutywa	51,0
King Williams Town	56,9
Libode	59,4
Lusikisiki	59,4
Mbizana	57,6
Sterkspruit	56.1

Source: Eastern Cape Social Economic Consultative (ECSECC, 2015)

King William's Town education district in the Eastern Cape of South Africa is not immune to the spiral down trend in educational standards. In 2011 Matric results, the district was ranked among the worst performing education districts in South Africa with a percentage score of 58.1%. The situation at the grade 9 level is not different from the performance at the Matric level. The average performance of grade 9 learners in mathematics in 2014 nationwide for instance has dropped to 10.8% (ANA, 2014). The average percentage mark in grade 9 mathematics in 2012, 2013 and 2014 in the nine provinces in South Africa is as shown below (ANA, 2014):

Table1.2: ***The average percentage mark in grade 9 mathematics 2012, 2013, 2014***

Province	Average mark (%)		
	2012	2013	2014
EC	14.6	15.8	13.3
FS	14.0	15.3	12.9
GP	14.7	15.9	12.4
KZN	12.0	14.4	10.7
LP	8.5	9.0	5.9
MP	11.9	13.7	11.3
NC	13.2	12.6	9.7
NW	11.2	13.3	10.6
WC	16.7	17.0	13.0
NATIONAL	**12.7**	**13.9**	**10.8**

Source: (Annual National Assessment, 2014)

Also, the national average percentage marks for mathematics in 2012, 2013 and 2014 from grade 1 to grade 9 in the Annual National Assessment (2014) shows a clear picture of the abysmal performance of mathematics among the grade 9 learners.

Table1.3: ***Mathematics average percentage mark from grade 1 – grade 9***

Grade	Mathematics Average Percentage Mark		
	2012	2013	2014
1	68	60	68
2	57	59	62
3	41	53	56
4	37	37	37
5	30	33	37
6	27	39	43
9	**13**	**14**	**11**

Source: (Annual National Assessment, 2014)

On the basis of the above considerations, a compelling case is made for the research that examined factors affecting grade 9 learners' performance in mathematics in the King William's Town education district of the Eastern Cape Province of the Republic Of South Africa, given the fact that no studies have been conducted previously to provide insight into the issue of grade nine learners performance in mathematics.

1.3 STATEMENT OF PROBLEM

King William's Town education district being listed among the ten poorly performing districts in mathematics in grade 9 is a cause for concern (ANA, 2012). This matter needs intensive research to find out the factors affecting learners' performance in mathematics due to the effect it will have on the individual and the nation at large.

King William's Town - despite a slight improvement in the Eastern Cape's 2014 Matric pass rate - remains the worst performing districts with three schools recording a zero percent pass (ECDoE, 2015). Mji & Makgato (2006:254) assert that, "outdated teaching practices and lack of basic content knowledge have resulted in poor teaching standards." They emphasised that the poor standards have been exacerbated by a large number of under qualified or unqualified teachers who teach in overcrowded and ill equipped classrooms.

Adu, Adelabu, & Adjogri (2014) observed that the use of ICT to support teaching and learning within mathematics remains under developed. They also stated that e–learning is the appropriate application of the internet to support the delivery of skills and knowledge in a holistic approach not restricted to a particular course, technologies or infrastructure; rather it includes all media employed in transmitting audio, video, data or multimedia such as cable satellite, fibre optics, wireless (radio, infra- red, Bluetooth, Wi-Fi).

The South African Democratic Teachers Union (SADTU, 2013) lays the blame for learners' performance in mathematics by high school students on the attitude of the students towards the subject. While the five teachers' unions - National Teachers Union (Natu), National Professional Teachers Organization of South Africa (Naptosa), South African Democratic Teachers Union (Sadtu), The Professional Educators Union (PEU) and The SA Onderwys Unie (SAOU) - stated that they did

not believe the ANAs in their "current form" were in the best interests of learners. (The five teachers' unions, 2015). In 2014 the final stage of the incremental implementation of the CAPS was completed in the Senior Phase in grades 7, 8 and 9. CAPS, therefore, provided stability in the sector by giving teachers clear guidelines on content, pedagogy and assessment and this has positively influenced learner performance in these phases (CAPS, 2009).

Given the assertions made by scholars, the researcher was motivated to investigate the factors affecting grade 9 learners' performance in mathematics. The main problem of concern in this study was to examine factors affecting grade 9 learners' performance in mathematics in the King William's Town education district.

1.4 RESEARCH QUESTIONS

1.4.1 Main research question

What are the factors affecting grade 9 learners' performance in mathematics in King Williams town education district?

1.4.2 Sub-research questions

i. How is the subject content introduced and taught by mathematics teachers?

ii. a). How does the motivation of educators affect the teaching of mathematics?

b). How does the motivation of learners affect learning of mathematics?

iii. What are some of the measures put in place by government to address the problem of learners' performance in mathematics?

1.5 OBJECTIVES OF THE STUDY

The objectives of the study were to:

i. Verify how the subject content is introduced by mathematics teachers.

ii. Examine whether the motivation of mathematics educators and learners will improve the performance of teaching and learning of mathematics in grade 9

iii. Identify some measures put in place by government to address learners' performance in mathematics.

1.6 SIGNIFICANCE OF THE STUDY

In this study, examining factors affecting grade 9 learners' performance in mathematics in the King William's Town education district will have significant public implications, as it will help identify learners' challenges in mathematics among high school students in South Africa. This in effect will help to improve the growth and development of the country when the challenges are addressed. The researcher also anticipates that this research will unravel the factors affecting learners' performance in mathematics among high schools in South Africa. By identifying these factors, the government, the Department of Education, parents, learners and non-governmental organizations (NGOs) will consider the suggested recommendations to improve the performance of mathematics in South African schools, Africa and the world as a whole.

1.7 SCOPE OF THE STUDY

First and foremost, the scope of the study was limited to grade 9 learners of public high schools in the King William's Town education district. High schools within the district were selected for the study. The aims of this study were limited to examining factors affecting grade 9 learners' performance in mathematics in the King William's Town education district.

1.8 DEFINITION OF TERMS

Poor performance:

A performance below the desirable results (ANA, 2014). It also refers to bad academic achievement.

Educator:

A person such as a teacher or a school administrator who has a job in the field of education (Merriam-Webster, 2015). An educator also refers to a teacher or a person who provides tutelage to a learner.

Learner:

Someone who is receiving formal education at a school (DoE, 2015). A person who is being taught by a teacher in a school is called a learner or a person who is undergoing tutelage.

Grade 9:

It is a grade in the senior phase of junior secondary school education (DoE, 2015). It is the senior phase of junior high school

Paradigm:

A paradigm is a conceptual model of a person's worldview complete with the assumptions that are associated with that view (Mertens, 2005).

Annual National Assessment (ANA):

Annual National Assessment (ANA) is an assessment programme use to measure progress and achievement in learner achievement in literacy and numeracy in South Africa. It also provides valuable feedback to schools, teachers, learners and parents.

Trends in International Mathematics and Science Studies (TIMSS):

Trends in International Mathematics and Science Studies (TIMSS) is an assessment programme used to test learners in mathematics and science globally.

1.9 LITERATURE REVIEW

A literature review was carried out to determine what had already been written on factors affecting learners' performance in mathematics. According to Creswell (2009) a literature review provides a framework for establishing the importance of the study as well as a benchmark for comparing results with other findings. The researcher depended on information from books, journals, dissertations and newspapers.

1.10 RESEARCH METHODOLOGY

The methodology used for this research was a mixed methods research approach. This is a methodology for conducting research that involves collecting, analysing and

integrating quantitative and qualitative research (FoodRisC, 2015). The instruments used for this study included observation, a structured questionnaire, and semi-structured interviews to elicit information from the learners and their educators. This method was suitable for the study because it captured the in-depth views of both the educators and their learners and also cross-checked the responses from the respondents to produce valid data.

1.11. POPULATION AND SAMPLING TECHNIQUE

The study population consisted of all grade 9 learners and mathematics educators handling grade 9 in the 57 selected public high schools in the King William's Town education district. A sample of 360 learners and five educators were selected using multiple sampling techniques, i.e. the stratified, simple random and purposive methods.

1.12 METHOD OF DATA ANALYSIS

The quantitative data was analysed using descriptive statistics of frequency distribution tables and graphs while inferential statistics was used to reach conclusions about the population of study based on a sample set of data. Qualitative data was analysed through the thematic approach of coding, sorting and categorization

1.13 ETHICAL CONSIDERATIONS

Voluntary participation

The researcher ensured that participation in the research was completely voluntary. Nobody was forced to participate.

Consent of the participants

The researcher sought the consent of the respondents before administering the research instrument. This was done by providing respondents with a consent form to complete before administering the questionnaires.

Anonymity of the participants

The researcher ensured that the identities of the respondents were guaranteed by not identifying any response with any respondent. Names of the respondents were not provided.

Confidentiality of respondents

Confidentiality of the respondents was ensured by the researcher. Thus the researcher held the respondents' information as confidential as possible and the information was used only for the intended purpose.

Permission

Permission was sought from the Department of Education and the principals of high schools where the researcher carried out the research. This was done by providing an introductory letter from my supervisor introducing me as a student to the Department of Education and the various principals of the high schools.

1.14 ORGANIZATION OF THE REST OF THE STUDY

Chapter one: consists of the introductory section of the study. It looked at the background to the study, statement of the problem, objectives of the study, significance of the study, scope of the study and organization of the study.

Chapter two: consists of the literature review. The chapter commences with an introduction, followed by the literature study.

Chapter three: focuses on the research methodology; it describes the research design, the study area, study population, sample size, sampling techniques, sources of data, data collection instruments and method of data analysis.

Chapter four: comprises of the presentation of the analysed data of the findings of the study.

Chapter five: deals with the summary of the analysed results after which conclusions are drawn. Recommendations are made based on the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides an account of the literature on factors affecting learning and factors affecting learners' performance in mathematics in high schools in South Africa. Creswell (2009) explains that a literature review provides a framework for establishing the importance of the study as well as a benchmark for comparing results with other findings. The term "factors" affecting learners' performance is used to emphasise how educators and the education system need to approach and remove existing factors hindering learners' performance in mathematics in high schools. The National Commission on Special Needs in Education and Training (NCSNET) (2001) and Department of Education (DoE) Draft Guidelines for Inclusive Education (2002:130-135) identified the following factors and some other factors affecting learning:

2.1.1 Inflexible curriculum

Research has shown that the rigid nature of the curriculum does not make room for all categories of learners. For instance, a visually impaired child will not benefit from the visual aids in the classroom nor the hearing impaired child benefit from the hearing aids in the classroom. According to Sauian (2002), the mathematics curriculum in developing countries is often based on studies as well as the experiences of the developed world. Invariably, the syllabi of the former are often adopted from the latter. Some scholars believed that there is an extraordinary similarity in the mathematics curriculum across the globe. The assessment process is also a hindrance to the performance of learners because a learner who cannot write legibly might fail his or her examination though he or she has the requisite knowledge. (Education White Paper 6,: 31 par. 2.2.6.1).

Responding to Diversity through the National Curriculum and Assessment Policy Statement (DoE, 2011a) is a set of guidelines that is intended to provide teachers, principals, subject advisors, administrators and other personnel with parameters and

strategies on how to respond to learner diversity in the classroom through the curriculum According to the Guidelines for Inclusive Teaching and Learning (2010), and the DoE (2010b:19), lesson plans have to provide differentiated learning, teaching and assessment activities to ensure effective multilevel teaching. However, in addition to these forms of differentiation, teaching and assessment activities will be adapted at lesson plan level for learners who need specific additional support as a result of individual barriers to learning mathematics. Differentiation at lesson plan level will also be required for all learners in a class who need specific additional support because of individualised barriers to learning.

2.1.2 Language and communication barriers

Usually, teaching and learning of mathematics takes place orally in the form of a language. Language that is not the home language of the educator or learner poses a great challenge. This challenge leads to low expectations of learners in their academic work. The medium of instruction in most rural schools in South Africa is the home language; however, the learning materials are in the First Additional Languages which are English and Afrikaans. Learners are therefore faced with the challenge of understanding the concept of mathematics in this regard. (Education White Paper 6:19). The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2008) conducted research across 26 countries showing that over 50 percent of students who dropped out of school did not speak the language in which they were being educated.

2.1.3 Attitudinal barriers

Fear and lack of awareness among educators, learners and the community pose a great challenge of discrimination against learners with disabilities. In South Africa, we are used to a segregated education system and most educators and learners lack the exposure to people with disabilities. In most communities in Africa, children with disabilities are hidden from the public. Most public facilities are also disability unfriendly. Learners with HIV/Aids experience stigmatization from their educators and peers. Education structures in various education districts are not enabled; neither do attitudes, teaching and learning methods as well as the curriculum reflect inclusive values (Swart & Pettipher, 2005:18).

2.1.4 Inaccessible and unsafe environment

The vast majority of sites of learning are not easily accessible to all learners, educators and community members, especially those who use wheel chairs. For example:

- Where access roads to schools are on steep inclines
- Where learners have to be dropped far away from school to complete the journey on foot due to lack of access roads
- Where there is youth violence in schools the fear factor prevents learners from regular attendance. Also, research has found that there have been reported cases of violence at some schools in South Africa and this makes learners feel unsafe and so they absent themselves from school (DoE, 2002).

2.1.5 Lack of management and administration skills among principals

Besides problems relating to administration and management at the provincial, district, and circuit levels, there is also evidence that administrative and managerial skills of school principals in some schools are not particularly impressive. The principal of a school represents the provincial department of education and the head of the school management team has the crucial role of professional and administrative leadership, and is responsible for the standard of learning and teaching in the school. Some teachers perceive school principals as autocratic. They do not involve staff in decision making processes of the school. This in effect hinders teaching and learning.

2.1.6 Inappropriate decision-making by the School Management Team

The South African School's Act 1996 was established to decentralised decision making to the school level by all stakeholders such as the School Management Team (SMT), the School Governing Body (SGB) and the Learners' Representative Council (LRC). Such decisions should be inclusive to ensure that decisions address the needs of the learners in the school. The main goal of the reform was to give the schools more control over how resources are spent so that they could be used more effectively and efficiently to improve learner performance (Stiefel et al., 2001:7). According to the findings of the study on school-based-budgeting (Stiefel et al.,

2001:7), many reforms aimed at improving public schools involve transferring control over resources from central authorities to school-level decision makers while at the same time holding school decision makers accountable for learner achievement. The underlying logic is that decision makers who are closer to the ground would be better able to allocate resources to learners with different backgrounds, learning styles, and needs in general. As a result this interest should change the allocation of resources in a way that leads to improvements in the level of academic performance because the allocation would be better aligned to the academic needs of that specific school (Stiefel et al., 2001:1). However, research revealed that most decisions taken by the school management team do not necessarily enhance the performance of the students' academic work.

2.1.7 Poverty

Ramala, (2009) observed that poverty has spatial, racial, and gender dimensions. The high poverty levels among the rural black communities in South Africa are largely due to high illiteracy and unemployment. This eventually affects the academic performance of their children in school. Research indicates that the Human Development Indices (HDI) vary considerably and the Limpopo Province has been identified as the one with the highest poverty rate of 77.9% followed by the Eastern Cape at 74.3%. This figure (74.3%) confirms that illiteracy and unemployment levels are linked to poverty. The demarcation of provinces and settlement patterns seems to be politically motivated and confirms the findings of the other studies. For instance, the black population lives in rural areas characterised by, among others, malnutrition (Statistics South Africa, 2001). The government produced a mechanism to address the problem of inequality at schools through the distribution of the education budget policy that provided a framework for allocating "non-personnel recurrent costs on the basis of need". A "resource targeting list" was developed informed by physical conditions, available facilities, the degree of overcrowding of the school, educator-learner ratio, availability of basic services, and the relative poverty of the community around the school. The main impact of the revised formula is that the poorest 40% of schools should receive 60% of the provincial schooling non-personnel budget allocation and the less poor 20% receive 5% of the resources (National Norms and Standards for School Funding, NNSSF Act, 1998).

2.1.8 Social attitude

Researchers have observed that there are many social practices that are not particularly encouraging for schooling in South Africa. One example of such practices is initiation. Among some black communities both boys and girls have to go to initiation school before they are recognized as adults. The initiation process requires that initiates, who are in most cases aged between 15 and 21, be kept away from home and the community for two to three months. The initiation practice is so highly valued that children are taken out of schools to undergo the process. In some communities, particularly the Xhosa in the Eastern Cape, the initiation period disrupts school in a more visible manner because it usually involves more people than the initiates. For example, younger family members of the initiates are required to take food to their brothers every morning and afternoon. Many schools are forced to either start later than usual or cope with scores of pupils coming to school late.

According to teachers and learners who were interviewed in various schools in the King William's Town district, some learners struggle to catch up missed work, resulting in poor performance (Interviews with educators and learners in schools in the King William's Town district, 2016).

Some of them lose the motivation to continue with school, while others distinguish themselves as 'men' and 'women' who cannot attend classes with or be taught by 'boys' and 'girls'. Learners in one school further indicated that a major problem regarding initiation and the extent to which it affects schooling is the attitude of the community which seems to value traditional practices more than school-based education (Interviews with learners, 2016).

2.1.9 Effects of racism on learning

Racism usually refers to the disengagement, denial, exclusion and unequal human value judgements that exist between people of different colour, race, culture and creed (News24, 2013). Racism can lead to many forms of emotional and physical atrocities against fellow human beings. It makes people feel excluded, punished and disabled in an environment where interpersonal, institutional and constitutional racism has been rife (News24, 2013). The impact of racism in South Africa has been profound, especially in schools. With many other facets of life in apartheid-era South

Africa, schools were designed to express and entrench an exclusionary ideology which informed school policies and practices Dawson (cited in Christie, 1985). In 1953 the Bantu Education Act removed education for blacks from missionary control and placed it under government control (Kallaway, 2002). A dual medium system was put in place that catered for English and Afrikaans speakers. Although primary school education for Africans was taught in their mother tongue, much of their secondary education was delivered in either English or Afrikaans (Kallaway, 2002).

The Department of Basic Education (2011) indicated that the province with the highest number of learners, schools and educators is Kwazulu-Natal. A total of 2.8 million learners attended 6180 schools with 93266 educators. The second best performer is Gauteng with two million learners attending 2599 schools with 71532 educators. Eastern Cape had 1.9 million learners attending 5755 schools with 68499 educators. The two provinces with the least number of learners, schools and educators are Northern Cape and Free State.

2.2 TEACHING AND LEARNING OF MATHEMATICS

2.2.1 Concept of learning in perspective

Learning is a relatively permanent change of behaviour resulting from experience (Bieheler & Snowman, 2000). Kolb (2005) enumerated the essential characteristics of learning as: learning is a continuous process based on experience, learning is a holistic process of adaption to the world, learning is the process of creating knowledge, and learning in the conventional sense is the process of absorption of knowledge resulting from the interaction between the teacher and the learner. A NCSNET report, (2000) indicated that what is actually learnt is a product of natural selection by the learner. Schoenfeld (1992:349) revealed that learners have misconceptions and misunderstandings which they bring to the classroom as their working tools. These misconceptions and misunderstandings therefore need to be addressed by their educators. A good mathematics educator needs to change the perception learners have towards the subject. One of the negative perceptions learners have towards mathematics is that "mathematics is meant for only those who are gifted and not for the non-gifted students". In the United States, many people believe that only a few "gifted" individuals have "what it takes" to learn mathematics, and that hard work cannot compensate for this. However, studies have shown "when

asked to explain why some children do better in mathematics than others, Asian children, their teachers, and their parents point to hard work, their American counterparts to ability" (Tobias,1993). Also some girls see mathematics as a subject reserved for the boys. These are negative impressions which need to be changed.

2.3 RETENTION AND MEMORY MODEL IN MATHEMATICS

Cognitive psychology underscores the stages of acquiring and processing information in order to generate one's own knowledge in learning. (Woolfork, 2013:228) asserts that the initial phase of information in learning mathematics is "sensory memory" or "sensory register". During this first phase the senses pay attention to and register selected stimuli while ignoring others (Schunk, 2008). (Woolfolk, 2013) observed that the human brain is selective in paying attention and this is affected by other factors that are happening concurrently. Therefore, divided attention caused by learners' negative behaviour could be the first stumbling block in learning mathematics.

The second phase is the cognitive process in learning mathematics. (Salvin, 2009) indicated that the brain can store information in the short-term memory. (Woolfolk, 2013) stated that the capacity of short-term memory is limited, and is able to hold five to nine items of information at a time for 15 to 20 seconds. Information that is learned well is sent for permanent storage in long-term memory. Information that is not processed in the short duration of working memory is discarded, making space available for processing new information. The implication of learners' negative behaviour on working memory is that it overloads the limited space of the working memory and reduces the attention span (Schenck, 2011).

The last phase in memory processing and learning mathematics involves remembering teachers' instructions, formulas, procedural operations and theorems. However, according to (Schenck, 2011), learners' forgetfulness is an everyday occurrence in mathematics lessons. (Salvin, 2009) noted that one important reason that learners forget is interference, which happens when information is mixed up with or instantly pushed aside by other information. The reason for this forgetfulness is that interference inhibits learners from absorbing the information by rehearsing it mentally and establishing it in their working memories (Salvin, 2009).

2.4 MATHEMATICS AND CULTURE

Researchers have shown that children's mathematical abilities differ across countries. In Canada, students score substantially lower in mathematics problem-solving and operations than students in Korea, India and Singapore. Also research showed that in countries such as Taiwan and Japan parents place more emphasis on effort rather than one's innate intellectual ability in school successes. By parents placing a higher emphasis on effort rather than one's innate intellectual ability they are helping their child develop a growth mind-set (Dweck, 2006).

Most Africans, especially the black race, perceive mathematics as a subject reserved for the white race Christine (cited in Maree, 2007). Hawson & Wilson (cited in Sauian, 2004:2) claim that a canonical school mathematics curriculum was developed in Western Europe in the aftermath of the Industrial Revolution and was adopted practically everywhere during the present century. In most of the developing world today the former mathematics education system was deeply embedded in the cultural and colonial heritage of the past. For example, Malaysia, Singapore and Hong Kong adopted the British system, the Philippines adopted the American system, while Vietnam and Cambodia adopted the French system and so on Nebres (cited in Sauian, 2004:2). Most countries have now revised and developed their own curricula though some of the contents still resemble the Western curriculum. The only variation is often reflected by the difference in socio-cultural background (Sauian, 2004:2).

There are differences in the level of mathematics education of the different countries. Each country has a different cross-cultural heritage, different medium of instruction, different level of educator training as well as different socio-economic positions (Sauian, 2004:3). Sauian, (2004:3) said the Chinese are well exposed to the urban-business environment as compared to the Malaysians who are traditionally rural people. This has resulted in a different perception of mathematics. In Indonesia, there is a significant difference in achievement in primary mathematics in rural schools compared to those in urban schools Armanto (cited in Sauian, 2004:3).

2.5 MATHEMATICS AND GENDER

Johns, Schmader, & Martens (2005) examined the effect of the teaching stereotype threat as a means of improving women's mathematics performance. The researchers concluded that women tended to perform worse than men in mathematics equations.

Mathematics is often labelled as a masculine ability; as a result girls often have low confidence in their mathematics capabilities. Gender also significantly predicts mathematics achievement. Gender differences in mathematical achievement have shown that boys significantly outperform girls (Kaahwa, 2012 & Ochwo, 2013). Conversely, (Namusisi, 2010) has reported girls outperforming boys. However, in a meta-analysis of 100 studies, (Hyde, Fennema & Lamon, 1990) found no or very small gender difference in mathematics achievement at the early primary level. But research shows that this trend seems to change in secondary school because girls show more mathematics anxiety than boys (Onolot-Okurut, 2005).

2.6 MATHEMATICS AND AGE

Mathematics achievement has been associated with age. The Uganda National Examinations Board (2013) reported that the mean scores in Mathematics of younger students in senior two (grade 8) were higher than those of their older counterparts within the same class. However, (Ayotola & Adedeji, 2009) reported that age had an insignificant negative correlation with mathematics performance of senior two students. Studies have found that prior mathematics achievement is a good predictor of students' mathematical success (Hemmings, Grootenboer & Kay, 2011). (West,1996) has pointed out that prior mathematics achievement is the single predictor that is statistically significant across all grades.

2.7 DEVELOPMENT OF LEARNING THEORIES

Different learning theories based on different schools in educational psychology have been proposed to explain how learning occurs. These include the perspectives of cognitive theory, gestalt theory, behaviourist theory, and constructivist theory. A cognitive psychologist explains that intuitive thinking, meaningfulness and organization of information are essential for learning to occur.

The cognitive theorist argues that a learner is capable of controlling his or her learning activity and organizing his or her field of operation and has an inherent capacity to learn (Mwamwenda, 2004:192). The gestalt theorist sees learning as perception and behaviour as a whole. According to the gestalt theorist learning should be observed holistically instead of being broken up into different components. They further argue that a given object is not understood by analysing its components one from another. It can only be understood by looking at the picture holistically (Mwamwenda, 2004:204).

According to Mwamwenda (2004:205), Gestalt psychologists argue that an organism cognitively formulates a number of hypotheses as to how the problem may be solved before it arrives at an insight into it. Once the organism has firmly decided which hypothesis should be used, it proceeds to use this to solve the problem. The behaviourist believes that learning is a function of change in overt behaviour. Changes in behaviour are the result of an individual's response to events (stimuli) that occur in the environment. The behaviourist further explains that learning occurs when the bond established between a stimulus and a response is reinforced in some way (Mwamwenda, 2004:171).

However, in this research the researcher based his study on constructivist theory. Formalization of the theory of constructivism is generally attributed to (Jean, 1957) who articulated mechanisms by which knowledge is internalized by learners. He suggested that through processes of accommodation and assimilation, individuals construct new knowledge from their experiences.

Constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas (Raskin, 2002). In constructivism, students need to construct their own understanding of each mathematical concept, so that the primary role of teaching is not to lecture, explain or otherwise attempt to "transfer" mathematical knowledge, but to create situations for students that will foster their making the necessary mental constructions. A critical aspect of the approach is a decomposition of each mathematical concept into developmental steps following a Piagetian theory of knowledge based on observation of, and interviews with students as they attempt to learn a concept (Jean, 1957).

Brownstein (2001) explains that, in constructivism, learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. This captures their motivation and builds on previous success to enhance learner confidence. This dramatic change of role implies that a facilitator needs to display a total different set of skills than that of a teacher. A teacher gives answers according to a set curriculum while a facilitator provides guidelines and creates the environment for learners to arrive at their own conclusions. A further characteristic of the role of the facilitator in the social constructivist view-point is that the instructor and the learners are equally involved in learning from each other as well (Willard-Holt, 2000).

2.8 DEVELOPMENT OF MATHEMATICAL CONCEPT

A mathematical concept is a general idea behind an equation, problem or formula in mathematics (Davis & Keller, 2014). The foundation for children's mathematical development is established in the earliest years. Mathematics learning builds on the curiosity and enthusiasm of children and grows naturally from their experiences. Appropriate mathematical experiences challenge young children to explore ideals related to patterns, shapes, numbers, and space with increasing sophistication (NCTM, 2000).

Teaching a mathematical concept is a multifaceted activity due to the unique set of experiences and ideas learners bring to the learning environment. The educator's role is important in planning and structuring effective instructions for the whole class. The educator has to explore a wide range of methods to meet the understanding of the learners. Educators who adopt a behaviourist way of teaching believe that learners learn by controlling the stimuli, choosing the correct response and providing the appropriate reward (Macleod & Golby, 2003). Behaviourist attributes learners' failure to lack of learners' innate abilities. However, educators with constructivism theory believe that learners' cognitive activity is basic in acquiring knowledge. Learners learn by constructing meaning from experience. A constructivist technique encourages learners to structure, provide meaning and organization to experiences and allows the individual to "go beyond the information given" (Macleod & Golby, 2003).

2.9 MATHEMATICAL PEDAGOGY

Mathematical pedagogy focuses on the systematic method in which teachers help their students understand and be able to do and use mathematics. Mathematics is a language of human action. For example, counting, folding, ordering, pairing, etc. As a result, this creates a language which we must use to reflect on that activity, learning to carry it out in our imagination and to name and represent it in symbols and images (Confrey, 1990).

Research has shown that the principles of mathematics are generally understood at an early age; pre-schoolers can comprehend the majority of principles essential to counting. By grade R, it is obvious for children to use counting in a more sophisticated manner by adding and subtracting numbers. Children begin to perform addition and subtraction mentally at approximately six years of age. When children reach approximately eight years of age, they can retrieve answers to mathematical equations from memory. With proper instruction, normally functioning children acquire these basic mathematical skills and are able to solve more complex mathematical problems with more sophisticated training (Kail & Zolner, 2005).

2.10 THE RURAL LEARNER

The rural mathematics learner is seen to be functioning in a system. According to Donald et al. (2002), the systems theory sees different levels and groupings of the social context as 'systems' where the function of the whole is dependent on the interactions between all parts. The rural mathematics learner is a system within the school environment, family, community, educator, parents, peers and curriculum. Therefore, for the rural mathematics learner to function effectively, the relationship between the different systems must be coordinated at all levels. If any aspect is distorted, it will negatively affect the rural learner. In addition to the general barriers enumerated earlier, the rural mathematics learner is at a disadvantage due to his/her environment.

2.11 THE MOTIVATION OF MATHEMATICS EDUCATORS AND LEARNERS

Motivation influences psychological and social functioning and facilitates academic performance as well as positive school perceptions (Gilman & Anderman, 2006:375-391). Research has shown that even the best teacher cannot force a student to learn

if the student is completely unmotivated. Psychologists observe that motivation enables students to initiate, guide and maintain goal-oriented behaviours. Mathematics education requires highly motivated students and mathematics educators because it requires reasoning, making interpretations and solving mathematical problems. The challenge of mathematics learning for today's education is that it lacks disciplined study, concentration and motivation. To meet these challenges, mathematics educators and learners must be focused and motivated enough to perform well. Motivation of mathematics learners and educators includes the following:

2.11.1 The school environment

Aside the brain development and training, the environment in which mathematics is learned also affects the performance of students and the delivery of the math educator. School context and its facilities could be an important factor in student achievement. Factors relating to the school environment have become a research focus among educational practitioners. The learning environment is a major factor in the mastery goals that students set (Kaplan & Maehr, 2007). For example, the degree to which students are motivated appears to be related to teachers' interest in and respect for their students, along with how the teachers enforce discipline. The more democratic the school environment, the more students are motivated by internal goals and the process of learning (Vedder-Weiss & Fortus, 2011, 2012).

The school environment must be creative enough to encourage learners to exhibit their mathematical talents. Language plays a major role in concept development in mathematics. In South Africa mathematics is taught in the second language which serves as an impediment to the learners who cannot read and write English or Afrikaans. This affects the performance of the learners because they find it difficult to understand and express their mathematical knowledge in the second language. Also, research has found that there have been reported cases of violence at some schools in South Africa and this makes learners feel unsafe and so they absent themselves from school (DoE, 2002).

2.11.2 The classroom environment

According to Rumberger & Palardy, (2004), classroom inputs and processes contribute to student achievement. Educational Effectiveness Research (EER) has observed that class composition was found to positively relate to mathematics achievement of students between classes (Van, Fraine, Opdenakker, Landeghem & Onghena, 2000). Research has shown that high-ability students perform best when associating with other high ability peers, while lower-ability students benefit from interaction with students in the middle of the ability distribution (Burke & Sass, 2011). The classroom learning environment and classroom assessment were among the eight teachers' variables included in the dynamic model for measuring quality of teaching (Creemers & Kyriakides, 2008). Rajoo (2013) has shown that the quality of the classroom learning environment is a significant determinant of students' mathematics achievement. Formative assessment is one of the most important factors associated with effectiveness at all levels (Creemers & Kyriakides, 2008). Stears & Gopal, (2010) have proposed interpretative and interactive approaches to assessment.

2.11.3 Condition of service of educators

The low morale of teachers due to their poor working conditions and remuneration packages contributes greatly to the poor performance of their students. It is often said that a healthy mind lies in a healthy body. Research has shown that teachers are not satisfied with their condition of service hence they find it difficult to give of their best. The salaries and benefits do not reflect society's recognition of the profession as one that needs complex skills and knowledge (Cherian & Mau, 2003:170). The South African Democratic Teachers Union (SADTU) observed that the retrenchment of temporary teachers in the Eastern Cape Department of Education had left permanent teachers overworked. The Union stated that some teachers who normally worked about 26-and-a-half hours a week were now forced to work more than 35 hours a week (SADTU, 2012). Teachers are also faced with the problem of working in overcrowded and poorly equipped classrooms (Mji & Makgato, 2006:254).

2.11.4 The educators' assessment

Research shows that the evaluation methods used by the educator plays a significant role in the motivation of the learner. If teachers provide clear evaluation criteria and individualised corrective feedback on tasks, the students' academic performance improves (Morais, 2002). Ramnarain (2013) found that summative examination systems facilitated extrinsic motivation in students and facilitated surface learning, as opposed to the deep learning required for studying mathematics and science.

2.11.5 Parental and societal contribution

The consensus among researchers is that parents and the society can exert a positive influence on their children's mathematical performance (Wamala, Kizito & Jjemba, 2013). Research has shown that parents and the society where learners reside greatly affect learners' mathematics performance. In a society where the people have interest in mathematics, their learners do well in the subject.

2.11.6 Teaching and learning materials (educational resources)

Teaching and learning materials are used by educators to arouse and sustain learners' interest in learning mathematics. To motivate learners to learn mathematics, teachers must make mathematics interesting by using recreational activities such as puzzles, board games, and manipulatives. Chess can teach students to strategize and calculate, while other games can teach maths related skills to help keep their minds sharp.

2.12 MEASURES PUT IN PLACE BY GOVERNMENT TO ADDRESS LEARNERS' PERFORMANCE IN MATHEMATICS

The government of South Africa has put in place a lot of measures to address learners' performance in mathematics. Research has shown that the government has developed a strategy for attracting, recruiting and selecting learners who have obtained good marks in mathematics and science to be trained as educators to teach specific scientific, mathematical and technological concepts and principles to young people at different level of grades (DoE, 2001). An upgrading programme was

also introduced to focus on upgrading the knowledge competences and skills of under qualified and unqualified educators already in the system (DoE, 2001).

Teachers handling mathematics have undergone a series of training and workshops in order to equip their skills and tap into modern learners' natural affinity for all things technological. Learners and educators have received laptops and tablets loaded with GMMDU's innovative curriculum-aligned classroom support package for grades 10 to 12. GMMDU is also running incubator schools for more than 400 selected learners from under resourced schools. Learners receive Android tablets which they are trained to use as a "personal tutor" after school hours (GMMDU, 2013).

The Dinaledi Schools Project was established in 2005 under the National Strategy for Mathematics, Science and Technology Education with the aim of increasing access to mathematics and science at higher levels in under privileged schools (DoE, 2007). The two National Curriculum Statements (NCSs) for grades R to 9 and grades 10 to 12 respectively were combined in a single document and will simply be known as the NCS grades R to 12. The NCS for grades R to 12 aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis across the country (NCS, 2012).

The government also introduced the Annual National Assessment programme use to measure progress in learners' achievement in literacy and numeracy in South Africa. This provides valuable feedback to schools, teachers, learners and parents. Among the closely monitored performance areas are learners' mathematics and physical science pass rates and the number of grade 12 learners qualifying for university entry (ANA, 2011).

2.13 FACTORS AFFECTING PERFORMANCE IN MATHEMATICS

According to Dednam (2005:199) all factors affecting learners' ability to understand mathematical concepts and processes are interconnected. It is therefore difficult to state which factor supersedes the other. Also, a complex and powerful ecological model involving different levels of systems in the social context developed by Bronfrenbrenner (cited in Donald et al., 2002:51) emphasises that various levels of the systems interact in the process of child development.

According to Bronfenbrenner (1994), child development should be seen as happening within four nested systems. The microsystem and the mesosystem constitute the interaction between two or more settings containing the developing person where various associations and actions take place. These may include the relations between home and school, or workplace, etc. For the purpose of this study the mesosystem (which is a set of microsystems associated with one another) included factors such as the cultural relevance of learning in South Africa.

The exosystem, on the other hand, also consists of the interaction between two or more settings, one of which does not contain the developing person. In this system events occur that do not directly affect processes within the immediate environment in which the developing person lives Bronfenbrenner (cited in Donald et al., 2002). For the purpose of this study, the exosystem emphasised the context in which learners do not participate directly but which has an impact on the functioning of important members of the learners' life, such as the socio-economic status of these individuals. The macrosystem consists of the overarching pattern with particular reference to the belief systems, bodies of knowledge, material resources, customs, life-styles, opportunity structures, hazards and life course options that are embedded in each of these broader systems Bronfenbrenner (cited in Donald et al., 2002).

In this study, a macrosystem was regarded as the relationship between culture and education, with particular emphasis on black communities' view of the status of the learner and the teacher. All these four systems mentioned above interact with the chronosystem (Donald et al., 2002:51). A chronosystem encompasses developmental time-frames (which span the duration of an individual's life) pertaining to family structure, socio-economic status and living conditions or the stress and ability in everyday life (Bronfenbrenner, 1994:40). For the purpose of this study, the chronosystem refers to the fact that environmental settings have multiple physical, social and cultural dimensions that can influence an individual's progressive stages of development. In this study, the chronosystem was used to explore the historical context of education in South Africa.

Bronfenbrenner has shown that the interactions that occur in face-to-face, long-term relationships (for example, lecturer and student) are the most important in shaping lasting aspects of development. Swart & Pettipher (2005) assert that the way

individuals perceive their circumstances influences the way they respond to their human and physical contexts. Children's own perception of their contexts is central to understanding how they engage with them. The environment does not simply influence the child. "Children are active participants in their own development. For example, if a child perceives his world as basically threatening, he will be less likely to explore it" (Donald et al., 2002:53). Therefore, if a child finds the learning of mathematics difficult to his very existence, he will develop no interest in the learning of the subject. Some of the factors affecting the performance of mathematics among high school students are enumerated below;

2.13.1 The attitude of the mathematics educator

The attitude of the mathematics educator plays an important role in the teaching and learning of the subject. An educator with a good attitude is welcoming, warm and has a sense of humour. A good mathematics educator is innovative, competent and has the ability to teach to the understanding of the learners. Goulding, Rowland, & Barber (2002) suggest that there are linkages between a teacher's lack of subject knowledge and ability to plan teaching materials effectively. These findings suggest that teachers that do not have sufficient background knowledge in mathematics may struggle with the development of comprehensive lesson plans for their students. Teachers not only need knowledge of a particular subject matter but also need to have pedagogical knowledge and knowledge of their students (Bransford et al., 2000).

Teacher competency in these areas is closely linked to student thinking, understanding and learning in maths education. There is no doubt that student achievement in maths education requires teachers to have a firm understanding of the subject domain and the epistemology that guides maths education (Ball, 1993; Grossman et al., 1989; Rosebery et al., 1992) as well as an equally meticulous understanding of different kinds of instructional activities that promote student achievement. Competent maths teachers provide a roadmap to guide students to an organized understanding of mathematical concepts, to reflective learning, to critical thinking, and ultimately to mathematical achievement.

Most mathematics educators are incompetent and also lack content knowledge of the subject. They find it difficult to create a positive mathematical environment that

best fits the development of the learner. Teachers who are themselves anxious about their mathematical abilities often dampen the zeal learners have for the subject (Gatto, 2013). Learners often come to school with abstract knowledge and potential for learning mathematics, but educators fail to identify, nurture and promote mathematical abilities in them. Diversity through the National Curriculum and Assessment Policy Statement (DoE, 2011a) is a set of guidelines that is intended to provide teachers, principals, subject advisors, administrators and other personnel with parameters and strategies on how to respond to learner diversity in the classroom through the curriculum.

2.13.2 Frequent changing of school and absenteeism

Learners who frequently change schools find it difficult to catch up with academic work since they may miss some of the lessons taught in the new school. Learners who have accumulated things to cover find it difficult to keep track with work. This leads to poor performance in mathematics. Also, absenteeism on the part of the mathematics educator and learner affects performance as there will be a backlog of things to cover. According to Dednam (2005:199), regular absence from school and change of schools are two of the most important causes of mathematical difficulties, as they cause backlogs in mathematics knowledge. In South Africa, learners who attend initiation schools absent themselves from school for a long time. This adversely affects the academic performance in school.

2.13.3 Temperature control

Temperature is a measure of how hot or cold a place is. Josean, Julio and Jose (2015) revealed that temperature clearly affects the attention span of students. The researcher observed that the winter and summer seasons have adverse effects on learners in South Africa. Schools that are too hot or too cold have a huge adverse effect on student performance. Conversely, schools that have well-regulated temperature control systems provide comfortable environments in which students can focus on scholastic tasks at hand, rather than sweating or shivering. Classrooms and other facilities that are too hot can exacerbate learning disabilities such as autism, and this can make students and teachers sleepy. Facilities that are too cold can exacerbate health impairments such as Attention Deficit Hyperactivity Disorder, making it difficult for students to concentrate in class.

Researchers also found a negative impact on student achievement where deficiencies of school features or components such as temperature, lighting, and age exist. In a study by Harner (1974), temperatures above 23°C (74°F) adversely affected mathematics skills. In terms of the condition of school buildings, Cash (1993) found student achievement scores in standard buildings to be lower than the scores of students in above standard buildings. In addition, Rivera-Batiz and Marti (1995) conducted multiple regression statistical analysis to examine the relationship between overcrowded school buildings and student achievement. The findings indicated that a high population of students had a negative effect on student achievement.

2.13.4 Effects of poverty on learners

Jolliffe in Charleston (2003:1) points out that in the United States poverty in the non-metropolitan areas exceeds that in metropolitan areas. Therefore, one might expect the achievement of rural learners to be lower compared to the national average. However, the best evidence available is based on the conclusions reached by a national effort to develop new research about mathematics education in rural areas.

In 1996 and 2000 the mathematics scores of learners on the National Assessment of Education Progress (NAEP) in USA showed some non-significant negative differences from the national average at all grade levels tested. These non-significant differences are at times interpreted as showing practical significance, though there is no consistency in the pattern in the direction of the difference as regards positive or negative conclusions. However, two conclusions seem to emerge about NAEP results. Over 25 years of testing and irrespective of the locale definition, there has been minimal change - increase or decrease - in the mathematics performance of rural learners.

Secondly, with few exceptions, recent performance of rural learners at NAEP grade levels differed from the national average. The observed non-significant differences are small. Sometimes they favour rural and small-town schools and have no practical implications. Studies conducted by Lee and McIntyre (2000) used NAEP 8th grade data for 1992 and 1996 to investigate state-level variability in rural versus non-rural mathematics achievement. According to the findings, a great deal of variation was evident at the state level. In seven out of 35 states non-rural learners' aggregate

scores were higher than those of rural learners. The study concludes that "rural learners in states where they have access to instructional support, safe or orderly climate and collective support tend to perform better than their counterparts in areas where they do not" (Lee & McIntyre, 2000). According to Kirov (2002), the high levels of illiteracy and unemployment among the rural black communities in South Africa are largely due to poverty.

2.13.5 Government policies

Some policies put in place by government do not enhance the teaching and learning of mathematics in High schools in South Africa. The learners' performance in mathematics in high schools is attributed to the large number of under qualified teachers employed to teach mathematics in poorly equipped classrooms. The Education For All EFA (2000) assessment (2005) reported that, in spite of approximately 85% of mathematics educators being professionally qualified, only 50% have specialized in mathematics in their training (DoE, 2001a). The mathematics audit report reveals that more than 50% of mathematics educators have had no formal subject training. Studies have shown that teachers with certification in mathematics are more likely to be passionate and committed about teaching mathematics than those without certification. However, those without certification vary in their commitment to the profession depending on coursework preparations (Laturner, 2002). Also teachers are not given in-service training to equip them to the modern trend of teaching mathematics. This adversely affects the performance of the learners.

2.13.6 Lack of school resources

The resources and infrastructure of a school is one major contributing factor to the performance of learners in mathematics. Research has shown that school resources, school size and students' socio-economic status are considered to be major factors that affect mathematics achievement because parents with full-time jobs and steady income send their children to large schools with more resources (Mohammadpour, 2012). Kyei & Nemaorani, (2014) have found school location and type to affect secondary students' mathematics performance in South Africa, where schools closer to town perform worse because students are distracted by entertainments, and students in private schools perform better than those in public schools. However,

Yusuf & Adigun (2010) found no significant influence of school location and type on achievement. The relationship of school size to educational outcomes remains controversial, as Slate & Jones (2005) concluded from their literature review that both very small and very large schools are negatively related to educational outcomes. Rumberger & Palardy (2004) refer to school processes as the teaching practices and social and/or academic climate of schools, among other features. In Flanders, an example of an educational system with tracking, Opdenakker & Van Damme (2001) showed that school composition and school processes jointly explain a sizeable amount of student variance in mathematics achievement at the end of the seventh grade.

2.13.7 Unstable home environment

Unstable home environment includes loss in the family through death, divorce, separation or substance abuse. Domestic quarrels by parents results in child neglect. Research on poor academic performance was conducted on African Americans (Saiduddin, 2003:22). The study found that factors influencing poor academic performance are poverty, cultural differences, unstable homes, drug abuse and teenage pregnancy. African American learners are exposed to a similar negative environment at home as learners in South Africa who also come from poor family backgrounds. The exposure of the youth to negative role models from an early age contributes not only to poor performance but also leads to school dropout. Hence, research has found that children from stable homes were less likely to repeat a school grade even when socio-economic status was removed statistically. Learners from unstable families are emotionally disturbed and therefore tend to under-perform (Adell, 2002:91). In South Africa, the researcher found that parents who abuse substances could not model the correct behaviour or be of any good role model to the young ones.

2.13.8 Anxiety

One of the major problems learners face in mathematics learning in high school is anxiety. Nolen-Hoeksenma (2013) defines anxiety as "an unpleasant state of inner turmoil, often accompanied by nervous behaviour, such as pacing back and forth, somatic complaints and rumination". Ashcraft (2002) also defines mathematics anxiety as "a feeling of tension, apprehension, or fear that interferes with

mathematics performance". Ashcraft suggests that highly anxious mathematics students will avoid situations in which they have to perform mathematical calculations. Research shows that many high school learners in South Africa exhibit mathematical anxiety when faced with a mathematical problem and try to avoid solving the problem. Unfortunately, mathematics avoidance results in less competency, exposure and mathematics practice leaving students more anxious and mathematically unprepared to achieve (Ashcraft, 2002). Learners feel anxious when engaged in situations where they have to participate socially and scholastically. This adversely leads to their poor performance in school.

2.13.9 Lack of parental recognition and involvement

There have been many studies that showed that parents' involvement in developing a child's educational processes is essential. Students' success in school is increased if their parents are involved in their education both at home and school (Henderson & Mapp, 2002). In addition, research has shown that parents' perception of mathematics influences their children's perception and achievement in mathematics (Yee & Eccles, 1988). This means that if parents make it apparent that they do not enjoy mathematics or they are not good at mathematics, this can influence the way in which their children view mathematics.

More often than not, school administrators' side-line the role of parents in the teaching and learning process. Where parents are not involved as partners in education provision, they become inactive in supporting their wards' learning. Parents who spend less time at home due to work and parents who have not had formal education will not be able to supervise and assist learning mathematics at home (Stewart, 2008). The researcher has observed that children who come from homes where parents are not educated in South Africa do not get the necessary assistance to do their homework and this leads to their poor performance in mathematics. In Uganda, Nsubuga (2008) observed that the role of parents, particularly through the Parent-Teacher Association (PTA), was instrumental to students' learning achievement.

2.13.10 Socio-economic status of parents

Socio-economic status is commonly determined by combining parents' educational level, occupational status and income (Jeynes, 2002). In most of the studies done on academic performance of learners, it is obvious that socio-economic status is one of the major factors contributing to the academic performance of the learner.

Socio-economic status is determined to be a predictor of mathematics achievement. Studies repeatedly discovered that the parents' annual level of income is correlated with students' math achievement scores (Eamon, 2005). Socio-economic status was found significant in primary maths and science achievement scores (Ma & Klinger, 2000). Socio-economic status was examined and found to be one of the four most important predictors of discrepancy in academic achievement of Canadian students (aged 15) in reading, mathematics, and science by the Program for International Student Assessment (Human Resources Development Canada, Statistics Canada, & Council of Ministers of Education Canada, 2001).

A number of studies showed that parents with higher socio-economic status are more involved in their children's education than parents of lower socio-economic status. This greater involvement results in the development of positive attitudes of children toward school, classes, and enhancement of academic achievement (Epstein, 1987; Lareau, 1987; Stevenson & Baker, 1987). Research shows that low socio-economic status negatively influences academic achievement because it prevents students from accessing various educational materials and resources, and creates a distressing atmosphere at home (possible disruptions in parenting or an increased likelihood of family conflicts) (Jeynes, 2002). Considene & Zappala (2002) argue that families where the parents are advantaged socially, educationally and economically foster a high level of achievement in their children's academic performance.

Howie (2006) found that family socio-economic status (SES) affects secondary students' performance in mathematics in South Africa.

2.13.11 Parents' educational level

Research has shown that students whose parents are highly educated out-performed their peers whose parents have low educational achievement. The

influence of the parents in the meta-cognitive trainings like study habits and achievement pressure can be considered as elements behind school performance (Quimbo, 2003). Parents' educational level has been shown to be a factor in academic achievement. Parents serve as a role model and a guide in encouraging their children to pursue high educational goals and desires by establishing the educational resources on hand in the home and holding particular attitudes and values towards their children's learning. In this case, the educational attainment of parents serves as an indicator of attitudes and values which parents use to create a home environment that can affect children's learning and achievement. A number of studies indicated that student achievement is correlated highly with the educational attainment of parents (Coleman, 1966). For instance, students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education (Campbell, Hombo, & Mazzeo, 2000). Research has shown that parents' educational level not only impacts student attitudes toward learning but also impacts their math achievement scores.

2.13.12 Psychological disorders

Learners with psychological disorders seem to have communication disorders as well. These learners exhibit verbal aggression or withdrawal behaviours to respond to colleagues or educators' invitations, or may use related responses to express their ideals or feeling. Such learners hardly contribute in class and also rarely seek for assistance when faced with mathematical problem.

2.13.13 Attitude towards mathematics

Researchers have examined the relationship between students' characteristics such as self-concept, attitudes towards mathematics, home background as well as motivation and students' subsequent academic performance. In general, a consistent pattern of attitudes towards school subjects and achievement in the respective subjects has been confirmed through a large number of studies (Papanastasiou, 2002). Papanastasiou (2002) showed that there is a positive relation between mathematics attitudes and maths achievement. According to Schereiber (2000), those who have positive attitudes toward mathematics have a better performance in the subject. In contrast with these findings, Cain-Caston's study (1993) showed that

for the third grade students there was no significant relationship between students' attitude toward mathematics and students' achievement in this subject.

Many studies have examined students' thinking about school and their attitude towards mathematics (Vanayan, White, Yuen & Teper, 1977 cited in Papanastasiou, 2000). Instruction in school settings provides one important and regularly experienced context in which ideas and perceptions about subject matters as well as other cognitive and affective outcomes can be shaped. According to the National Research Council (2000) as cited in Akey (2006), students' beliefs about their competence and their expectations for success in school have been directly linked to their levels of engagement, as well as to emotional states that promote or interfere with their ability to be academically successful. Thus attitudes determine the effort a student is likely to put into his learning of mathematics.

Lytton (2000), refers to the environmental effects that influence the child's development. These environmental effects may come from extra-parental influences, such as peer groups and social pressures. The negative attitudes many learners have toward mathematics stifle their understanding. Some are of the view that mathematics is a subject reserved for the gifted and that it is difficult to learn. This reduces the learners' motivation to learn. The difficulties many learners experience in learning mathematics can be likened to low self-confidence for the subject.

2.13.14 Educators' inability to understand learners' construction of mathematical ideas

Research has shown that most educators find it difficult to understand learners' construction of mathematical ideas. Maher and Davis in Ward (2001:2) emphasise that educators must be able to understand learners' constructions that differ from their own. They recount the story of two learners and their educator who interpreted a problem differently. The problem involved two pizzas, each of which was sliced into twelve pieces. The problem asked what fraction of the two pizzas was eaten by seven learners if each ate one piece from each pizza. The two young boys used two pizzas as their unit and reported that 14/24 of the two pizzas was eaten. The educator who was using one pizza as her unit wanted them to answer 7/12 of a pizza. The learners' answer was not incorrect with respect to the presentation of the question, but the educator was using a unit different from the one the boys used, so

she saw their construction as incorrect. She explained her correct answer, as she saw it, to them but did not give them time to use their manipulative to build the new knowledge from her explanations. When given the same problem the next year, the boys used the knowledge that they had constructed and arrived at their original answer (Maher & Davis in Ward, 2001). This example demonstrates that constructed knowledge was retained and the information received through direct instruction was forgotten. Communication between learners and educator is another essential aspect of constructivism. Had the educator in the example been attuned to the boys' explanations, she would have realized that theirs was also correct. Communication must be present for the educator to know how the learners' knowledge has been constructed.

Educators need to realize that solutions are built from past constructions and therefore will probably differ from their own. They must be willing to accept this diversity as long as it is mathematically valid (Ward, 2001:2).

2.13.15 Disorganization

Learners who misplace or lose belongings have difficulty handling materials with multiple pieces. Working memory affects the ability to mentally manipulate several numbers at a time and to manage the number of steps required to solve a problem. They have messy desk and difficulty handling mathematical problems within a time frame. Simple solutions to subtraction problems are committed to memory, while more complex problems are solved through working memory and the recall of strategies. Additionally, problems with multiple steps rely on a longer processing sequence drawn from the working memory.

2.13.16 Attention deficit related problems

A short attention span can make it difficult for learners to follow all the steps needed to complete a mathematical problem. Others leave the work uncompleted or they skip some steps. They often ask the educator to repeat the explanation or for help (Dednam, 2005:201). Such learners find mathematics difficult and boring. Serame, (2013) observed that learners' lack of concentration and boredom are the most prevalent misbehaviours in classrooms in South African rural schools, causing great concern to teachers.

2.13.17 Reading difficulties

Baroody & Coslick, (2008) indicate that learners with reading difficulties also find it difficult to read numerals, for example confusing six and nine, and reversing numerals and writing a seven back to front. Poor reading causes difficulties in reading mathematical combinations and construction of word sums. Also some of the mathematical terms serve as a hindrance to the learners. Learners who have external locus of control feel that what happens in their lives comes from outside and so have no contribution to make and feel helpless when trying to learn mathematics (Donald et al., 2002:101). They are passive in the learning process.

2.13.18 Effect of sensory motor skills regarding the learning of mathematics

Dednam, (2005:201) observed that lack of gross motor, visual motor and motor skills especially at pre-school level may adversely affect learners' performances in mathematics at a later stage. In addition to this, she also asserts that deficiency in fine motor coordination, tactual kinaesthetic and visual motor integration can also impair the learning of mathematics. In terms of auditory problems, learners' are faced with the challenge of differentiation between numbers which sound almost the same or count correctly in higher order and this affects the learning of mathematics. The same can be said of the difficulty of handling addition and subtraction operations simultaneously. A study showed that visual difficulties, that is coping with basic concepts in mathematics relating to a digit's position in a number such as 15 to its value, poses problems for learners and this is referred to as "visual perception difficulties". Also the researcher identified that learners are not able to differentiate between mathematical operations such as +, -, x and ÷ (Dednam, 2005:201).

Other learning problems that Lerner, (1993:209) identifies are what she calls "passivity" and also "mathematical readiness". These learners probably lack confidence in learning mathematics because their past learning experiences were often dismal exercises in failure and frustration. These learners do not believe they can learn mathematics; they do not know how to go about the task of learning. As a result they become passive and dependent learners (Lerner, 1993:209).

2.13.19 Substance abuse among high school learners

Researchers have observed that there is a high rate of substance abuse among high school learners in South Africa which affects their studies. Morojele, (2006) observed that alcohol was found to be the primary substance abuse amongst students, regardless of age or level of substance involvement. Adolescents who develop alcohol problems generally begin drinking alcoholic beverages in the form of wine, beer or distilled spirits during their early or mid-teen years.

2.14 PARADIGMS REGARDING THE LEARNING OF MATHEMATICS

Every mathematics educator needs a holistic approach in teaching mathematics. Maree, (2013) cited Kuhn's definition of a paradigm as a set of beliefs which is accorded a status of being so fundamental that it does not need any testing to prove its authenticity. The following paradigms were used to explain the learners' shortfalls in the learning of mathematics:

2.14.1 Curricular paradigm

The curricular paradigm argues that most mathematics learning materials are outmoded; yet mathematics is a very fast growing field (Steen in Maree, 2013).

2.14.2 Social paradigm

According to Maree (2007), social paradigm deals with poor educational background, domestic instability, insufficient parental counselling, and poor adaptation to change learning and educational circumstances leading to under achievement. (Grossnicke, Reckzeh, Leland & Ganoe, 2008) explain that, unless these factors are adequately accommodated, learners cannot achieve much in mathematics.

2.14.3 Dyscalculia paradigm

The dyscalculia paradigm deals with learners who lack the ability to learn mathematics. The learners do well in other disciplines but perform poorly in mathematics. According to the review in Szucs & Goswami (2013), the dyscalculia paradigm is a selective weakness of mathematics and about 6% of children and adults are affected by it. Szucs & Goswami (2013), attest that intelligence, reading and motivation to learn are normal. Access to appropriate educational provision is

also normal with people suffering from developmental dyscalculia. About 50-60% of children with developmental dyscalculia have a persistent condition. Around 95% of children with developmental dyscalculia show long-term weak mathematical performance Shalev et al. (cited in Szucs & Goswami, 2013).

2.14.4 Dyspedagogia paradigm

Dyspedagogia paradigm argues that the mistakes learners make in mathematics come from unsatisfactory teaching. Gannon & Ginsburg (cited in Maree, 2013), explained that, unsatisfactory teaching includes teaching inadequacy and lack of teaching learning materials. Some educators lack the ability to explain mathematical concept to the learners.

2.14.5 Psychoanalytic paradigm

The psychoanalytic paradigm describes mathematics problems as symbolic or subconscious behaviour. Once those factors affecting poor performance are eliminated, a higher achievement level is guaranteed. Visser, Morgan, Dees & Dees (cited in Maree, 2013) explain that the problem of mathematical anxiety attest to this paradigm.

2.14.6 Developmental paradigm

The developmental paradigm is of the view that children reach a stage in their development where they are able to master mathematical concepts. This by implication will not afford the child the opportunity to acquire those mathematical skills if the child has not reached the necessary developmental stage. For the child to be in a position to understand various concepts in the mathematics curriculum the child should be in a position to carry out essential mathematical skills for each grade level.

2.14.7 Behaviourist paradigm

The behaviourist paradigm views mathematical problems as the result of behaviour learnt. Mathematics learning is an external activity exclusively planned by the educator. Therefore, unwarranted mathematical mistakes are behaviour which had been learnt. Efforts must be made to rectify this. Educators need to teach learners

the basic skills and principles in mathematics rather than dwelling on the analysis of learners' mistakes.

2.14.8 Cultural paradigm

The cultural paradigm suggests that it will be immature to assume that mathematics is culture free Woodrow (cited in Maree, 2010). Some scholars believe that mathematics is meant for a certain category of people - mostly whites Christine (cited in Maree, 2014). This ideology of bias also exists in the content of mathematics books in the sense that the books are western oriented Hudson (cited in Maree, 2010).

2.14.9 Medical paradigm

The medical paradigm argues that problems in mathematics arise from chemical or organic malfunctioning of the learner. The learner's inability to achieve is attributed to poor genes or physical defects inherited from the parents. Not much can be done to remedy the defect.

2.14.10 Eclectic paradigm

Maree (1992:34) argues that there is the eclectic paradigm which says that any of the above-mentioned or unmentioned paradigms are valuable when evaluating the difficulties that any particular learner experiences in mathematics. Therefore, Maree (1992:29) advises that "Mathematics educators as well as psychologists in dealing with more 'technical' problems in mathematics as well as the treatment of emotional problems connected to mathematics, should take cognizance of these paradigms in an unbiased way".

2.15 THE ROLE OF SCHOOL INFRASTRUCTURE IN LEARNING

Poor facilities impede teaching and learning, and this also affects the morale of educators and learners. Good physical facilities promote learners' performance. It may seem more rational to start school improvement exercises with the curriculum, but the school buildings play a key role in the performance of the learners. The outcomes are visible (Cherian & Mau, 2003:169). A study conducted by Pallas & Pong, (2001) on mathematics in nine countries found that only the United States of America (USA) had smaller classes to improve the performance of mathematics.

According to Ralenala (2003) thousands of schools still have poor physical infrastructure and many are dilapidated, dangerous, and unfit for human habitation. There is often no water in school or good sanitation. These conditions do not only restrict the teaching and learning activities in the school but also threaten the health of learners and educators as well. This could influence absenteeism of both learners and educators. This problem has affected the performance of learners in mathematics.

2.16 LEARNER PROFILES

The performance of learners should be investigated in line with their opportunity-to-learn indicators (learner-profiles). Indicators such as attendance of classes would highlight anomalies regarding their attendance, which might be regular or irregular, and such indicators are early signs that might determine whether learners will perform well academically or not, and remedial measures could be implemented before it is too late. Learner-profiles also indicate the positive effects of participation of learners in extra-curricular activities in Wisconsin where learners involved in extra-curricular activities tend to improve in their performance unlike those who are not participating (Burmaster, 2005).

2.17 CONCLUSION

This chapter highlighted several factors that affected learners' performance in mathematics in high schools globally, and in South Africa for which King William's Town education district is no exception. These factors could be traced to; the attitude of the learners and educators towards mathematics, frequent changing of school and absenteeism, temperature control, effects of poverty on learners, government policies, lack of school resources, unstable home environment, anxiety among learners, parents educational level, psychological disorders, disorganization, reading difficulties, substance abuse etc. This literature review therefore suggests a forensic inquiry into factors affecting learners' performance in mathematics. The next chapter will look at the methodology employed for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The aim of this study is to examine factors affecting learners' performance in mathematics in grade 9 in the King William's Town education district.

This chapter presents the research paradigm, research approach, research design, area of study, population, sampling method, stratified sampling method, research sample, data collection procedures, data collection instruments, pilot study, interviews, observations, validity of data, ethical considerations and limitations of the study.

3.2 RESEARCH PARADIGM

A research paradigm is defined as a framework for observation and understanding a research problem (Babbie & Mouton, 2002:645). A pragmatism research paradigm was adopted by the researcher for this study. The pragmatic paradigm is often associated with mixed methods research which is problem centred. What is important for the pragmatic researcher is the practice itself (Creswell et al., 2007:23). Mixed methods provide the opportunity for presenting a greater diversity of divergent views (Teddlie & Tashakkori, 2003:15-16). In pragmatism, data are collected by using numbers and words to address the research problem (Henning et al., 2005:23). For this study, the researcher adopted mixed methods research because, from the ontological point of view, the researcher believed in constructing multiple realities to understand the problem under study. For these realities to be unearthed it was important to build a relationship between the researcher and what is to be researched (Creswell et al., 2007:24). In this study, the researcher interacted with a lot of grade 9 learners from different schools and different social backgrounds and their educators to gain insight into the way learners make use of mathematics in their daily lives and the challenges encountered in learning mathematics. The researcher used the pragmatism research paradigm because it is able to answer research questions that other methodologies cannot answer and it also provides better (stronger) inferences. This paradigm enabled the researcher to get a better

understanding of the factors affecting performance in mathematics among high school learners.

3.3 RESEARCH APPROACH

The researcher used a mixed methods research approach. The mixed methods research approach is a methodology for conducting research that involves collecting, analysing and integrating quantitative and qualitative data (FoodRisC, 2015). The researcher obtained quantitative data by administering structured questionnaires to grade 9 learners and educators teaching mathematics in grade 9. Qualitative data were obtained through semi-structured focused group interview and observations made by the researcher. Mixed methods research approach was thus adopted by the researcher because it was suitable for the studies. This approach captured in-depth views of both the educators and their learners. Mixed methods research benefits from the complementary strengths of the different approaches (Teddlie & Tashakkori, 2003:19). The researcher also adopted this research approach because it ensured effective and flawless collection of data. Data collected from the learners and educators were cross-checked to ensure that they were authentic information for the study. The adoption of mixed methods in a single study adds rigor, breadth, complexity, richness and depth to any inquiry Flick (cited in Denzin & Lincoln, 2000:5). The mixed methods approach has a lot of advantages associated with it. The strength includes:

1. **Logic of triangulation**. The findings from one type of study can be checked against the findings deriving from the other type. For example the results of a qualitative investigation might be checked against a quantitative study.

2. **Qualitative research facilitates quantitative research**. Qualitative research may help to provide background information on context and subjects; act as a source of hypotheses; and aid scale construction.

3. **Quantitative research facilitates qualitative research**. Usually this means quantitative research helps with the choice of subjects for a qualitative investigation.

4. **Quantitative and qualitative research are combined in order to provide a general picture of the study.** Quantitative research may be employed to plug the

gaps in a qualitative study which arise because, for example, the researcher cannot be in more than one place at any one time, or if not all issues are amenable solely to a quantitative or a qualitative investigation.

5. **Structure and process**. Quantitative research is especially efficient at getting at the structural features of social life while qualitative studies are usually stronger on process aspects.

6. **Researchers' and subjects' perspectives**. Quantitative research is usually driven by the researcher's concerns, whereas qualitative research takes the subject's perspective.

7. **Problem of generalizability.** The addition of some quantitative evidence may help generalizability.

8. **Qualitative research may facilitate the interpretation of relationships between variables**. Quantitative research readily allows the researcher to establish relationships among variables, but is often weak when it comes to exploring the reasons for those relationships. A qualitative study can be used to explain the factors underlying the broad relationships.

9. **Relationship between macro and micro levels**. Employing both quantitative and qualitative research may provide a means of bridging the macro-micro gulf. Qualitative research can tap large-scale structural features of social life while qualitative research tends to address small-scale behavioural aspects (Adapted from Punch, 1998:247).

However, the method has some disadvantages as enumerated below:

1. The research design can be very complex.
2. It takes much more time and resources to plan and implement this type of research.
3. It may be difficult to plan and implement one method by drawing on the findings of another.
4. It may be unclear how to resolve discrepancies that arise in the interpretation

of the findings (Adapted from FoodRisC, 2016).

3.4 RESEARCH DESIGN

Du Plooy (2001:81) defines a research design as a plan of how the research will be conducted, indicating who or what is involved and where and when the study will take place. In this study the researcher used the concurrent triangulation design. Concurrent Triangulation Design involves concurrent but separate collection and analysis of quantitative and qualitative data (Creswell et al., 2003). According to Erina (2013) concurrent triangulation research design cross checks information to produce accurate results for certainty in data collection. The researcher used concurrent triangulation design because it is suitable for a mixed methods research design. Quantitative and qualitative data were collected separately yet concurrently. The findings were then integrated during the interpretation phase of the study giving equal priority to both types of the research. This design was used to confirm, cross-validate, or corroborate findings from the [redacted] and quantitative data collected from the participants. It was also used to develop a more complete understanding of a phenomenon in the study.

3.4.1 Strengths of Concurrent Triangulation Design

1. It is used to validate and substantiate findings from a study.
2. It is also used to compare sequential designs and data collection takes less time.

3.4.2 Weaknesses of Concurrent Triangulation Design

1. It requires great effort and expertise to adequately use two separate methods at the same time.
2. It can be difficult to compare the results of two analyses using data of different forms.
3. It may be unclear how to resolve discrepancies that arise while comparing the results.
4. Given that data collection is conducted concurrently, results of one method (e.g. interview) cannot be integrated in the other method (e.g. survey) (FoodRisc, 2016).

3.5 AREA OF STUDY

This study was conducted in the King William's Town education district. Grade 9 learners and educators teaching grade 9 mathematics within King William's Town public schools were selected for the study.

Fig.1.

A map of King William's Town

Source: *AfricGIS (2016) (Pty) Ltd. Google*

King William's Town is a town in the Eastern Cape province of South Africa along the banks of the Buffalo River. The town is about 30 minutes' motorway drive WNW of the Indian Ocean port of East London. The town is part of the Buffalo City Metropolitan Municipality in the Eastern Cape. King William's Town stands 389-m above the sea at the foot of the Amatola mountains and in the midst of a densely populated agricultural district. It is the second most populous city in the Buffalo City Municipality, with a population near 100,000 inhabitants.(Eastern Cape Department of Education, 2015).

3.5.1 Population of study

Arkava & Lane (cited in Strydom, 2005a:193) define the term population as: A term that sets boundaries on the study units. Population refers to individuals in the universe who possess specific characteristics relevant to the study. The population in this research study was all grade 9 learners and educators teaching grade 9 mathematics in King William's Town education district. Arkava & Lane (cited in Strydom & Venter, 2002:198) refer to a universe as "all potential subjects who possess the attributes in which the researcher is interested". In South Africa, grade 9 learners are in the Senior Phase of Junior Secondary School education. It is the foundation stage of secondary school education.

3.5.2 Sample

A sample is a subset of people, items, or events from a larger population that you collect data from and analyse to make inferences (Minitab, 2015). Hendricks (2006:2) explains that samples allow the researcher to generalize results to the larger population from which the sample was drawn. Reid & Smith (cited in Strydom, 2005a:194) are of the opinion that feasibility is the main reason for sampling. It is almost impossible to include a total population in a specific study, mostly because all of them are simply not reachable. For this study, a sample of 57 public high schools within King William's Town education district was selected taking into consideration the proximity of the schools to the researcher. Three hundred and sixty (360) grade 9 learners and five educators were drawn through the multiple sampling techniques of stratified, simple random and the purposive method. The learners comprised of 216 females and 144 males and the educators were 2 males and 3 females.

3.5.3 Sampling method

The sampling methods best suited for this study were employed by the researcher. These were the multiple sampling techniques of stratified sampling, simple random and purposive sampling.

3.5.4 Stratified method

Denscombe (2007:14) defines stratified sampling as one in which every member of the population has an equal chance of being selected in relation to their proportion

within the total population. The researcher divided the 57 public high schools into five distinct strata.

Table.3.1: *The stratum with number of schools*

STRATUM	NUMBER OF SCHOOLS
A	11
B	11
C	11
D	12
E	12
TOTAL	**57**

Source: Field study (2016)

Seventy-two (72) grade 9 learners and one educator teaching grade 9 mathematics were then taken from each stratum based on the ratio of the subgroup sizes to the total data population.

Table 3.2: *The number of learners and educators selected from each stratum*

STRATUM	NUMBER OF LEARNERS	NUMBER OF EDUCATORS
A	72	1
B	72	1
C	72	1
D	72	1
E	72	1
TOTAL	**360**	**5**

Source: Field study (2016)

The significant advantage of stratified sampling over pure random sampling is that the social researcher can assert some control over the selection of the sample in order to guarantee that crucial people or crucial factors are covered by it, and in proportion to the way they exist in the wider population (Denscombe, 2007). This method enabled the researcher to select the desirable learners for the study taking into consideration their assessment in mathematics in school and the general performance of the school.

3.5.5 Simple random method

In this study the simple random method was used by the researcher to select 10 grade 9 learners' to participate in the focus-group interview using a sampling guide. The researcher selected a sample of 10 participants by writing "YES" and "NO" on pieces of paper. The papers were folded and put into a container. This was shuffled many times by the researcher and he asked participants to pick one piece of paper each. Those who picked "YES" participated in the focus-group interview. According to Bernard (2006:146) simple random sampling entails that every unit of analysis has an equal chance of being chosen for study because it eliminates bias.

Advantages of the simple random method include the following:

1. It reduces the potential of human bias in the selection of cases to be included in the sample.
2. Simple random sampling provides us with a sample that is highly representative of the population being studied, assuming that there is limited missing data.
3. Since the units selected for inclusion in the sample are chosen using probabilistic methods, simple random sampling allows us to make generations from the sample to the population (Cookies & Privacy, 2012).
4. It needs only a minimum knowledge of the study group of the population in advance.
5. It is very easy to assess the sampling error in this method (Matters, 2016).

Disadvantage of simple random sampling include the following:

1. A simple random sample can be carried out only if the list of the population is available and complete (Cookies & Privacy, 2012).
2. In simple random sampling, the selection of the sample becomes impossible if the units or items are widely dispersed.
3. The method cannot be employed where the units of the population are heterogeneous in nature.
4. It may be impossible to contact the cases which are very widely dispersed (Matters, 2016).

3.5.6 Purposive sampling method

One of the sampling methods best suited for the study is the purposive sampling method. Purposive sampling is described by Babbie (2004:183) as a type of non-probability sampling where the respondents are selected on the basis of the researcher's own judgment regarding which respondents possess the attributes needed and who will add the best representation to the study. This study was conducted with grade 9 learners of King William's Town education district in the Eastern Cape province of South Africa. It was aimed at getting to the main factors affecting the mathematics performance of high school learners in the district.

The researcher selected schools that performed poorly in the previous Matric examination and the Annual National Assessment for the past years for the study. Denscombe, (2007:17) indicates that, with purposive sampling, the sample is 'hand-picked' for the research. "The term is applied to those situations where the researcher already knows something about the specific people or events and deliberately selects particular ones because they are seen as instances that are likely to produce the most valuable data" Denscombe, (2007). Learners with poor school assessment especially in mathematics and mathematics educators teaching in the poor performing schools in the district were also selected by the researcher for the study using the purposive sampling method. This enabled the researcher to get first-hand information from the learners and their educators. The advantage of purposive sampling is that it allows the researcher to hone in on people or events which there are good grounds for believing will be critical for the research (Denscombe, 2007:17).

3.6 DATA COLLECTION PROCEDURES

The data collection procedure deals with the procedure of gaining access to the schools, creating a rapport with the authorities and the learners of the school, the data collection method, pilot study, administration of the measuring instrument, interviews, observations, ethical considerations, limitation of the study and conclusions.

3.6.1 Gaining access

First of all, an introductory letter from my supervisor was issued by the researcher to the Department of Education to negotiate for permission to carry out the research (Appendix A). The Department of Education also issued me with an introductory letter to the principals of the various public schools (Appendix B). This was done to follow the rules and regulations in public schools concerning access. Arrangements were made with research participants whereupon time schedules were drawn up and agreed upon (Denzin & Lincoln, 1998:57). Depending on the contingencies of the setting and the research problem chosen, there are two kinds of research access that may be obtained (Denzin & Lincoln, 2000):

- "Covert" access without subjects 'knowledge of researchers' presence.
- "Overt" access which is based on informing participants and getting permission from all of them, often through 'gatekeepers'. In this case gatekeepers are the Department of Education and the principals. In this study, the researcher chose the "overt" access which was relevant to this study due to the fact that my participants had the choice to participate or not (Denzin & Lincoln, 2000).

3.6.2 Creating a rapport

Since the researcher is not a member of staff, he had to create a relaxed atmosphere for the participants. The presentation of oneself is very important because it leaves a deep impression on the respondents and has great influence on the success (or failure) of the study. The explanation of the research's purpose and getting permission from the Department of Education, principals, educators and learners were done. The researcher indicated to the participants that their participation was voluntary and the collected information would be strictly confidential. The researcher explained to them that the aim of the study was to examine factors affecting performance in mathematics among grade 9 learners and also to find ways to improve it.

3.6.3 Data collection instrument

Data collection instruments are the tools that the researcher uses to collect data. In this study the researcher used a structured questionnaire, semi-structured

interview and observations to collect data. According to the World Health Organization (WHO) (2016), semi-structured interviews are based on the use of an interview guide. This is a written list of questions or topics that need to be covered during the interview. The researcher used short notes and a tape recorder to record the responses of the interviewees.

Strengths of a semi-structure interview are as follows:

1. It provides in-depth information about what is being studied.
2. Respondent can influence the topic, and unexpected issues/topics emerge during the interview.
3. It also enables the researcher to probe to understand perspectives and experiences.

However, some of the weaknesses of semi-structured interview are:

1. Analysis of the findings was difficult because it must be done by people who carried out the interviews.
2. Analysis was time consuming.
3. It was also difficult to generalize findings from the study.

During the semi-structure interview, the researcher observed and made notes on non-verbal communication like silence, laughing, and worried expressions.

According to Boundless (2016), observation allows researchers to experience a specific aspect of social life and also get a first-hand look at a trend, institution, or behaviour. During observation, participants may or may not be aware of the researcher's presence, and the researcher does not try to control variables or ask participants to respond to direct questions.

Advantages of observation are:

1. Observation captures behaviour that is more natural than behaviour occurring in the artificial setting.
2. Observation is also particularly advantageous as a cross-cultural reference.

Disadvantages of observation are:

1. It can be time consuming. Some studies require a lot of observation.
2. Without the use of multiple researchers, the chances of observer bias increase because behaviour is perceived so subjective (Boundless, 2016).

The researcher adopted these instruments so that almost all issues can be covered for the study. A pilot study preceded the interviews to highlight errors in advance. Some of the information was obtained through casual conversation with participants.

3.6.4 Pilot study

According to Van Teijlingen & Hundley (2001:1) a pilot study refers to a mini version of a full-scale study (also called a 'feasibility' study), as well as the specific pre-testing of a particular research instrument such as a questionnaire. The pilot study is a crucial element of a good study design. Conducting a pilot study does not guarantee success in the main study, but it does increase the likelihood. De Vos (2005:402) states that pilot testing is designed to determine whether the intervention will work. Fawcett et al. (cited in De Vos, 2005:402) elaborate on this statement saying that in their opinion the pilot test helps to determine the effectiveness of the intervention and identifies which elements of the prototype may need to be revised. The structured questionnaire was piloted on ten grade 9 leaners. During this period the researcher realised that a question was confusing to the respondents. It was not probing enough to get the detailed information from the respondents so the researcher had to restructure that question for a clearer understanding.

3.6.5 Administration of measuring instrument

In all, two sets of structured questionnaires were administered - one set for the learners and the other set for the educators. The questionnaire for learners was structured into three parts. The first part (Section A) dealt with the biographical information about the learners such as:

1. Age
2. Parental educational level

3. Employment status of parents
4. Literacy level of parents
5. Staying with parents or not
6. Proximity of homes to school
7. Means of transport to school (Appendix C)

Section B dealt with the difficulties learners encounter in the learning of mathematics and the attitude of their mathematics educators. Section C dealt with suggestions from the learners.

The structured questionnaire responded to by the educators was also structured into sections A, B and C. The information elicited from the educators was characterised as:

1. Age
2. Years of teaching
3. Qualification of educator
4. Educators' major subject at college / university
5. Curriculum changes
6. Teaching strategy / modes of teaching
7. Membership of educators' association. (Appendix D)

The focus group interviews (Appendix E) yielded information on the factors affecting learners' mathematics performance.

The researcher used the above measurement instruments due to their immense advantages which are relevant to this study. It enabled the researcher to access large samples and it was less costly. According to Neuman (1997:272), a questionnaire is an effective way to reach people in remote areas and can yield a high response rate. Consequently, information gathering using questionnaires is considered appropriate for this study.

The researcher is, however, aware of the challenges involved in using the questionnaire as an instrument of measurement. One of these challenges is that good questionnaires are difficult to design (Sanders, 1995:92). Another problem is that respondents may present inaccurate information about themselves. Several efforts were made by the researcher to overcome these challenges. These included

using questionnaires that had been piloted on a small group of learners by the researcher. The use of focus group interviews to collaborate information derived from the questionnaire responses was also an attempt to enrich and complement the findings with qualitative data. In terms of the contention of Fraenkel and Warren (1990:402), low response rate of questionnaires could be minimised by sending the questionnaires to persons in authority to administer to potential respondents. In this study, since the researcher cannot speak the local language of the learners (isXhosa), he requested the assistance of the grade 9 mathematics educator to help him in administering the questionnaires to the learners during break time. This approach also helped the researcher to eliminate the possibility of having incomplete answers to the questionnaire items. In this study, questionnaires proved to be more cost effective than face-to-face interviews, which Neuman (2000:273) asserts can be expensive.

Semi-structured questionnaires were also used for the focus group interviews in this study for their inherent advantages to the research. A focus group may be defined as an interview style designed for small groups.

Basch, Lengua et al. (cited in Berg, 2004:123) assert that in focus group interview, the researcher sought to learn through discussion conscious, semi-conscious and unconscious psychological and socio-cultural characteristics and process among various groups. According to Denzin & Lincoln (2000:836) focus groups allow access to research participants who may find one-on-one, face-to-face interaction "scary" or "intimidating". Focus group data are group data in that they reflect the collective notions shared and negotiated by the group.

In this particular research the focus group interviews allowed the researcher to interact with learners in an informal way that allowed discussions to take place, where appropriate, in their mother tongue, which is IsiXhosa. It also allowed the researcher to elicit information on other areas of the questionnaire where learners could not provide written responses and also cross-checked their responses with the structured questionnaires.

3.6.6 Observations

Observations are used by researchers applying the qualitative approach. The strategy is used as a principal data-gathering strategy in qualitative research because researchers are interested in the ways in which people usually make sense of or attach meaning to the world around them (De Vos, 2001:277-281). In this study the selected observed factors that the researcher concentrated on are the following: time management, classroom environment and outside classroom as well as the physical appearance and learners' attitude to study.

3.6.7 Time management

In this study the researcher focused on the issue of time management by learners. The strategy allowed the researcher to observe the behaviour of the learners at school, during lessons as well as after the lessons. The researcher observed critically what transpired during lunch and break periods to learn how learners use their leisure time and how they respond to the siren/ bell as it marks the beginning and the end of each lunch and different learning periods respectively and all the data was captured as field notes.

3.6.8 Classroom and outside classroom environment

The researcher's observations were on the behavioural patterns of learners inside the classroom, the classroom temperature as well as on the location of the school in relation to other local facilities such as clinics and different types of businesses to see if such facilities could be a factor contributing towards poor performance in mathematics.

Notes were taken by the researcher, which served as the basis for the identification of emerging patterns of learner behaviour and the temperature under which learners learn mathematics. The information was then merged and, in terms of time management, response to siren/bell, classroom environment and classroom temperature, going out in groups, direction to the toilets, shops, or home, and spaces within/out of school premises.

3.6.9 Physical appearance and learners' attitude to study

Another thing the researcher took critical note of was the physical appearance of the learners' uniforms, their hairstyles and facial expressions when it was time for mathematics and their attitude towards learning. Their participation in class was also noted. The observation was continuous each time the researcher visited the schools. The appearances of the educators were also observed, including their mode of dressing and their relationships with the students. The manner in which they responded to students' questions in class and how warm and welcoming they were to students was also noted.

3.6.10 Validity of data

Validity and credibility play a very vital role in research work. According to Cronbach, & Khan (cited in Phye, Robinson & Levin, 2005:128), validity is determined by degrees of authenticity of data collected and is a continuous process of gathering evidence and formulating an argument to support score interpretations. In this research the researcher used a variety of instruments to ensure the authenticity of the data collected from the respondents.

The mixed methods approach adopted by the researcher ensured credibility (parallels internal validity) (Mertens, 2005:302). By triangulating methods the validity of the research is strengthened (Sandelowski, 2003:322; Onwegbuzie & Teddlie, 2003). Cronbach's alpha coefficient was used to measure the reliability of the questionnaire. This statistic is an overall item correlation where the values range between 0 and 1. Values above 0.7 are often considered to be acceptable. A Cronbach's alpha coefficient for the study was 0.82. The trustworthiness for the semi-structured interview was ensured by documenting exactly what the participant had said and what was observed during the interview. For the validity of the research instruments to be ensured, the researcher gave the questionnaires and the semi-structured interviews to experts in the field to do corrections and adjustments before administering them.

From an interpretivist's perspective, validity refers to how well the research method investigates what it intends to investigate (Lewis & Ritchie, 2003). The following are some examples of validity adopted by the researcher:

3.6.11 Face validity

Face validity occurs where something appears to be valid. This of course depends very much on the judgment of the observer. In any case, it is never sufficient and requires more solid validity to enable acceptable conclusions to be drawn.

Measures often start out with face validity as the researcher selects those which seem likely prove the point (Changingminds, 2016).

3.6.12 Construct validity

Construct validity occurs when the theoretical constructs of cause and effect accurately represent the real-world situations they are intended to model. This is related to how well the experiment is operationalized. A good experiment turns the theory (constructs) into actual things you can measure.

Construct validity was use by the researcher to assess the quality of an instrument or experimental design. It is used to measure the construct it is supposed to measure. If you do not have construct validity, you will likely draw incorrect conclusions from the study (Changingminds, 2016).

3.6.13 Content validity

Content validity arises when the experiment provides adequate coverage of the subject being studied. This includes measuring the right things as well as having an adequate sample. Samples should be both large enough and be taken for appropriate target groups. The perfect question gives a complete measure of all aspects of what is being investigated. However, in practice this is seldom likely; for example, a simple algebra item does not test the whole of mathematical ability.

Content validity is related very closely to good experimental design. A high content validity question covers more of what is sought (Changingminds, 2016).

The qualitative data was used to provide the context within which the quantitative data must be interpreted. The sampling is an additional measure of quality assurance. Consistency was maintained throughout the process of data collection because it is an important aspect of reliability.

3.7 ETHICAL CONSIDERATIONS

Balnaves & Caputi, (2001:239) state that the purpose of ethics is to make researchers aware of the issues that may arise in their work, and to encourage them to educate themselves and colleagues to behave ethically.

Robertson & Dearling, (2004:33) highlight that ethics is about the moral position adopted by the researcher and those funding that piece of research. Each of these groups has a moral obligation to protect people from any mistreatment that could result from taking part in the research itself. The following ethical concerns were relevant in the context of this study:

i. The researcher ensured that participation in the research was completely voluntary. Nobody was forced to participate.

ii. Consent: The researcher sought the consent of the respondents before administering the instrument.

iii. Anonymity was guaranteed by not identifying any response with any respondent.

iv. Confidentiality of respondents was ensured. Thus the researcher held respondents' information as confidential as possible and the information was used only for the intended purpose.

v. Permission was sort from the Department of Education and the principals of high schools where the research was conducted.

3.8 LIMITATIONS

The inability of the researcher to speak the local language of respondents was problematic. This condition was minimized by engaging the services of a colleague who is fluent in both English and isiXhosa. The schools being far away from the researcher were also a problem.

3.9 CONCLUSION

This mixed methods research was carried out according to research methodology best suited to supply the most reliable results. This chapter focused on the research methodology which formed the basis of this research study. The practical enactment of the different aspects that formed part of the process in its entirety was discussed according to the methods in which it was implemented, how it progressed and how it was concluded.

The following chapter provides discussions and graphical representation of the empirical findings from the study. A reflection on the results obtained and an analysis of this information forms part of the content of this chapter, and serves as a true reflection of the outcome of the study.

CHAPTER FOUR

DATA ANALYSIS

4.1 INTRODUCTION

This section presents the result of the study. Data were collected through a structured questionnaire, semi-structured interview and observation. The structured questionnaire for learners and educators had three sections: the biographical information, factors affecting performance of learners in mathematics and recommendations. The semi-structured interview also yielded information on factors affecting learners' performance in mathematics. Descriptive and inferential statistics were used to analyse the quantitative data while the thematic approach of coding, sorting and categorising was used to analyse the qualitative data.

4.2 QUANTITATIVE DATA ANALYSIS

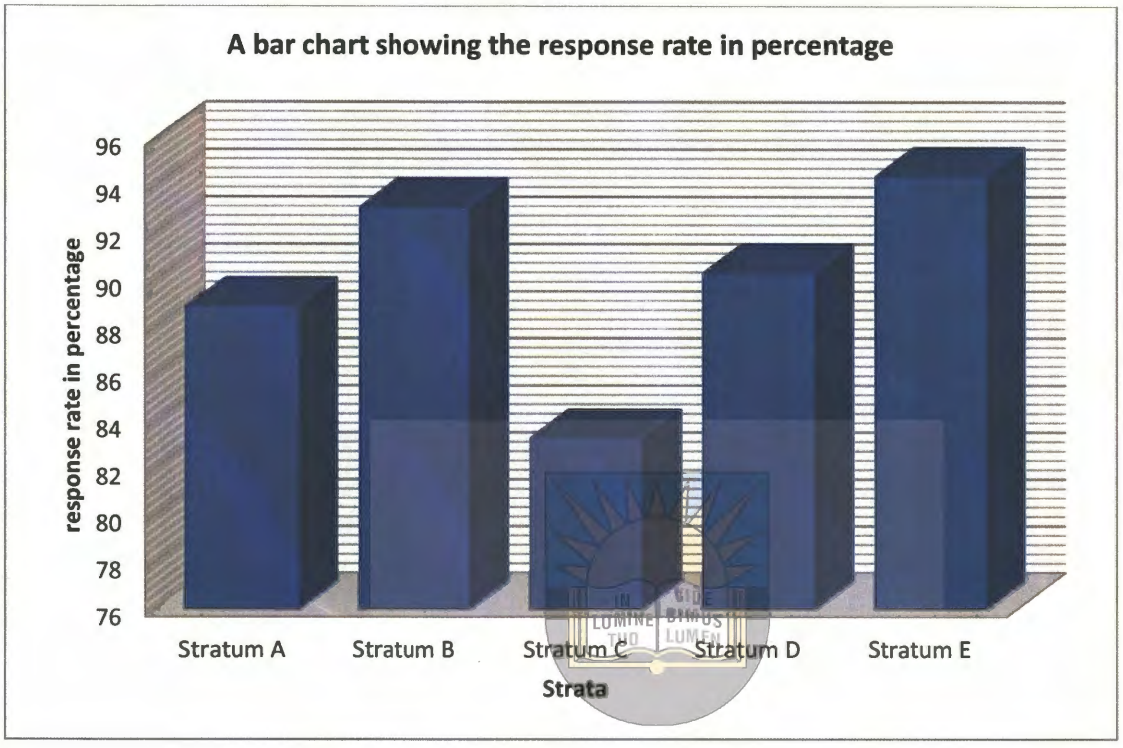
Three hundred and twenty-four (324) out of the three hundred and sixty (360) learners completed and returned their questionnaires. This gives a response rate of ninety percent (90%).

Table 4.1: *The number of questionnaires distributed and the number returned*

Stratum	No. of questionnaires distributed	No. of questionnaires returned	Response rate in percentage (%)
A	72	64	88.9
B	72	67	93.1
C	72	60	83.3
D	72	65	90.3
E	72	68	94.4
Total	**360**	**324**	**90.0**

Source: *Field study (August, 2016)*

Fig.2.



The response rate in percentage.

Source: *Field Study (August, 2016)*

The selected respondents were used to represent the larger population. However, respondents did not return all the distributed questionnaires as expected. Some of the respondents might not know what to write and others did not see the need for it.

From the Figure 2, it can be deduced that stratum E had the highest response rate of ninety-four percent (94%); this was followed by stratum B with ninety-three percent (93%), and the third group was stratum D with ninety percent (90%), while stratums A and C had eighty-nine (89%) and eighty-three (83%) response rate respectively.

According to Bailey (1992:165), a response rate of fifty percent (50%) is sufficient for analysis of data, a response rate of sixty percent (60%) can be said to be "good", seventy percent (70%) is classified as "very good", eighty to ninety percent response rate is said to be "excellent". It can therefore be seen that the response rate for this research was an excellent one.

4.3 ANALYSIS OF LEARNERS' BIOGRAPHICAL DATA

The purpose of this biographical item was to elicit information about the learners' age, race, parental educational level, employment status of parents, living with parents or not, and means of transport to school. The questionnaire was responded to by three-hundred and twenty-four (324) learners selected from fifty-seven (57) public high schools in King Williams Town education district.

4.3.1 Age of learners

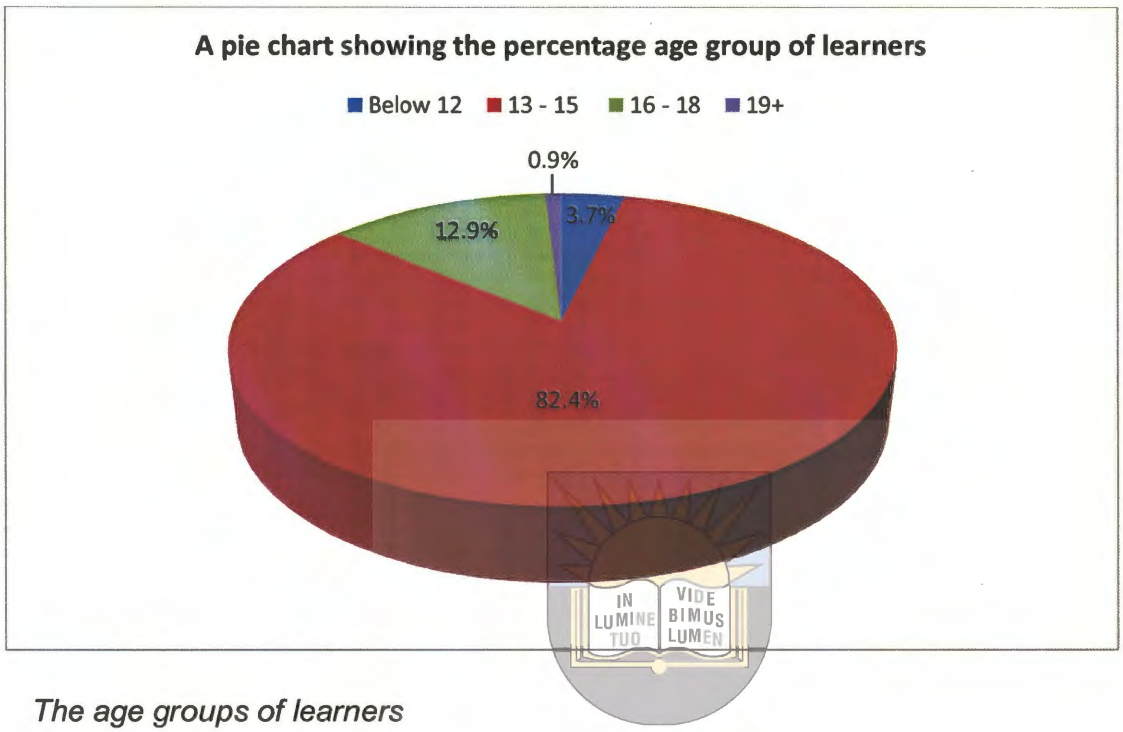
The purpose of this question was to determine the average age of grade 9 learners. The age group of learners is represented in the table below.

Table 4.2: *The average age of grade 9 learners*

Age category	No. of learners	Percentage
Below 12	12	3.7
13 - 15	267	82.4
16 - 18	42	12.9
19+	3	0.9
Total	**324**	**99.9**

Source: *Field study (August, 2016)*

Fig.3.



The age groups of learners

Source: *Field study (August, 2016).*

From the Figure 3, it can be deduced that two-hundred and sixty-seven (267) learners translated to 82.4% who are in the age category of 13-15. This is followed by forty-two (42) learners who represent 12.9% in the age category of 16-18, twelve (12) learners translated to 3.7% in the age range of 12 years and below and three (3) learners representing 0.9% are in the age category of 19 years and above.

From the above illustration, it can be observed that the average age of grade 9 learners as at the time of the survey was within 13-15 years. Ayotola & Adedeji, (2009) revealed that age had an insignificant negative correlation with mathematics performance of senior students. Studies have found that prior mathematics achievement is a good predictor of students' mathematical success (Hemmings, Grootenboer & Kay, 2011)

According to the South African Schools Act of 1996, schooling is compulsory for all South Africans from the age of seven (grade 1) to the age of 15, or completion of grade 9. This is classified as General Education and Training (SouthAfrica.info, 2012).

4.3.2 Gender classification of respondents

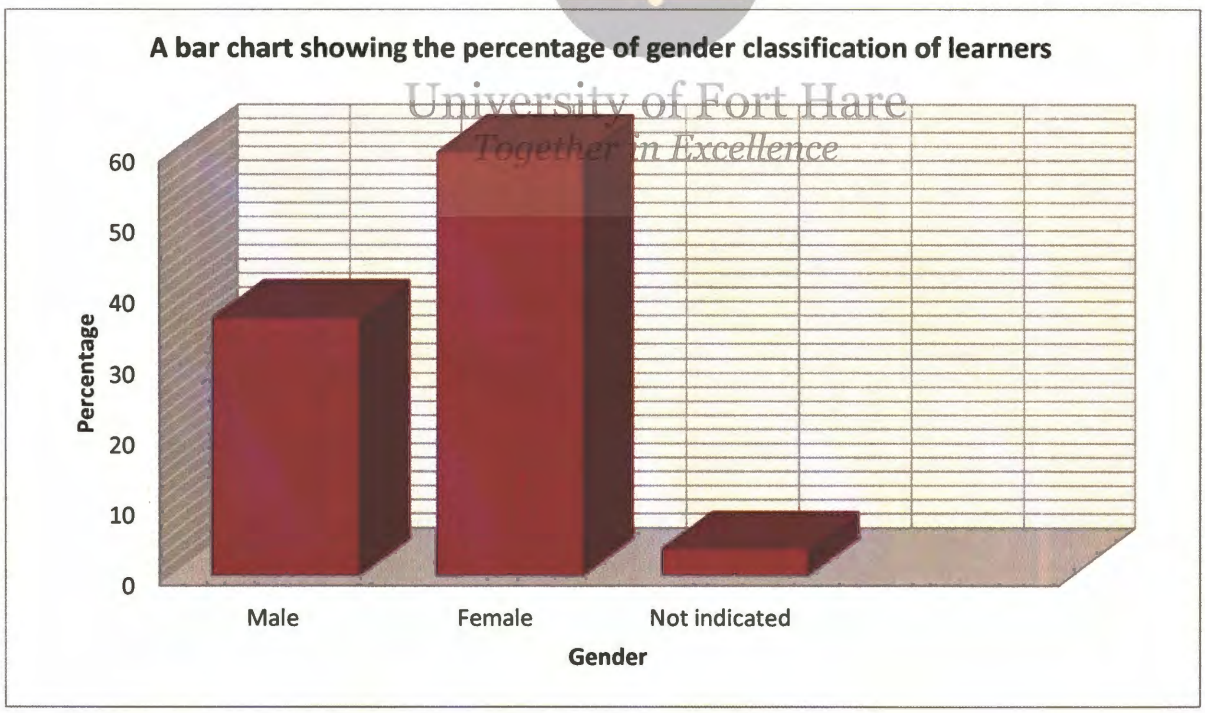
The rationale for this item was to determine the sex status of learners in grade 9.

Table 4.3: *Gender classification of learners*

Gender	No. of learners	Percentage
Male	118	36.4
Female	194	59.9
Not indicated	12	3.7
Total	324	100

Source: *Field study (August, 2016)*

Fig. 4.



Percentage of gender classification of respondents.

Source: *Field study (August, 2016)*

Table 4.3 and Fig. 4 indicate that females dominate their male counterparts in terms of numbers in grade 9 as at the time of the survey. With a total number of three-

hundred and twenty-four (324) respondents, one-hundred and ninety-four (194) representing 59.9% percent are females as compared to one-hundred and eighteen (118) male respondents representing 36.4%. Twelve (12) of the respondents did not indicate their gender status.

A possible explanation for not indicating their gender could be that they did not understand the question or did not want to state their gender status. It is obvious from the above Fig.4.3 that there were more female learners in grade 9 than male learners. The reason could probably be male learners dropped out of school before grade 9 or do not regularly attend school.

Gender differences in mathematical achievement have shown that boys significantly outperformed girls (Kaahwa, 2012 & Ochwo, 2013). Conversely, Namusisi (2010) has reported that girls outperform boys.

However, Hyde, Fennema & Lamon, (1990) found no or very small gender difference in mathematics achievement at the early primary level. But research shows that this trend seems to change in secondary school because girls show more mathematics anxiety than boys (Opolot-Okurut, 2005).

4.3.3. Race classification of respondents

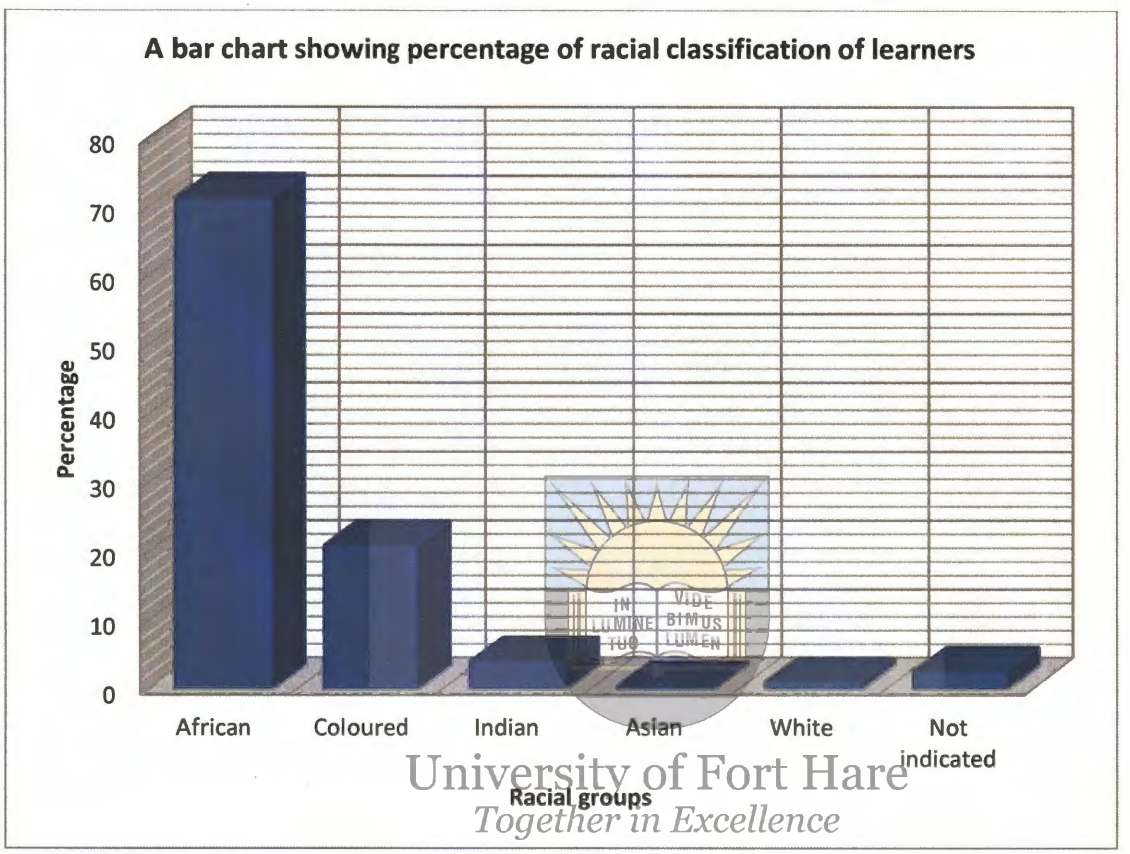
The main rationale for this questionnaire was to determine the dominant racial group in grade 9.

Table 4.4: *The racial groups in grade 9*

Race	No. of learners	Percentage
African	231	71.3
Coloured	68	20.9
Indian	13	4.0
Asian	1	0.3
White	3	0.9
Not indicated	8	2.5
Total	324	99.9

Source: *Field Study (August, 2016)*

Fig.5.



The percentage of racial classification of respondents.

Source: *Field study (August, 2016)*

From the Table 4.4 and Fig.5, it can be deduced that the majority of the learners are African. Two-hundred and thirty-one (231) of the respondents translating to 71.3% are African. This is followed by the coloured group with sixty-eight (68) representing 21%. Thirteen (13) learners representing 4% are Indians. Three (3) respondents representing 0.9%) are white, one (1) respondent representing 0.3% is an Asian, and eight (8) respondents representing 2.5% did not indicate their race.

A possible explanation for not indicating their race could be that they did not understand the question or they did not want to indicate their race. However, it could be concluded that the majority of grade 9 learners in King William's Town education district are African as at the time of the survey.

According to Christine (cited in Maree, 2007), most Africans especially the black race perceive mathematics as a subject reserved for the white race. Hawson & Wilson (cited in Sauian, 2004:2) assert that a canonical school mathematics curriculum was developed in Western Europe in the aftermath of the Industrial Revolution, and was adopted practically everywhere during the present century.

4.3.4 Caretaker of the learner

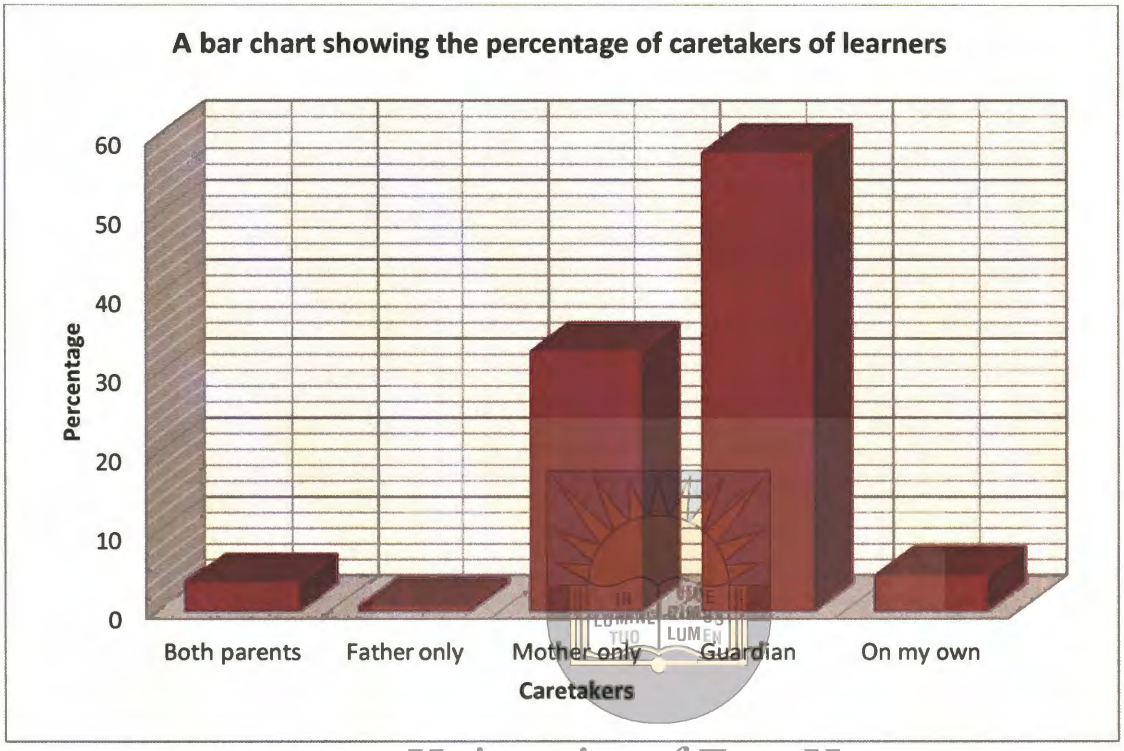
The purpose of this questionnaire was to find out whom the learner is residing with at home or who is taking care of the learner.

Table 4.5: *The caretakers of learners*

Caretaker	No. of learners	Percentage
Both parents	12	3.7
Father only	2	0.6
Mother only	107	33.0
Guardian	188	58.0
On my own	15	4.6
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.6.



The percentage of caretakers of learners.

Source: *Field study (August, 2016).*

From the Fig.6 it can be deduced that one hundred and eighty-eight (188) respondents translating to 58.0% are living with their guardians/grandparents, one hundred and seven (107) respondents translating to 33.0% are living with their mothers alone, fifteen respondents (15) representing 4.6% are living on their own, twelve (12) respondents representing 3.7% are staying with both parents and two (2) respondents translated to 0.6% are living with their fathers only.

It can be deduced from Table 4.5 that most of the learners are living with relatives especially with their grandparents and not with their biological parents. The explanation of this could possibly be related to the death of both parents or the absence of both parents from home.

Most of the learners are also living with only their mothers. This could also be related to the possible death of their fathers or the neglect of fatherly responsibilities or divorce. It could be observed that some of the learners are also living on their own. A

possible explanation of this could be the death of both parents or neglect of both parents' responsibilities.

Learners from unstable families are emotionally disturbed and therefore tend to under-perform (Adell, 2002:91). A research conducted by Saiduddin (2003:22) on poor academic performance of African Americans found that factors influencing poor academic performance are poverty, cultural differences, unstable homes, drug abuse and teenage pregnancy.

4.3.5 The highest educational level of parents/guardian

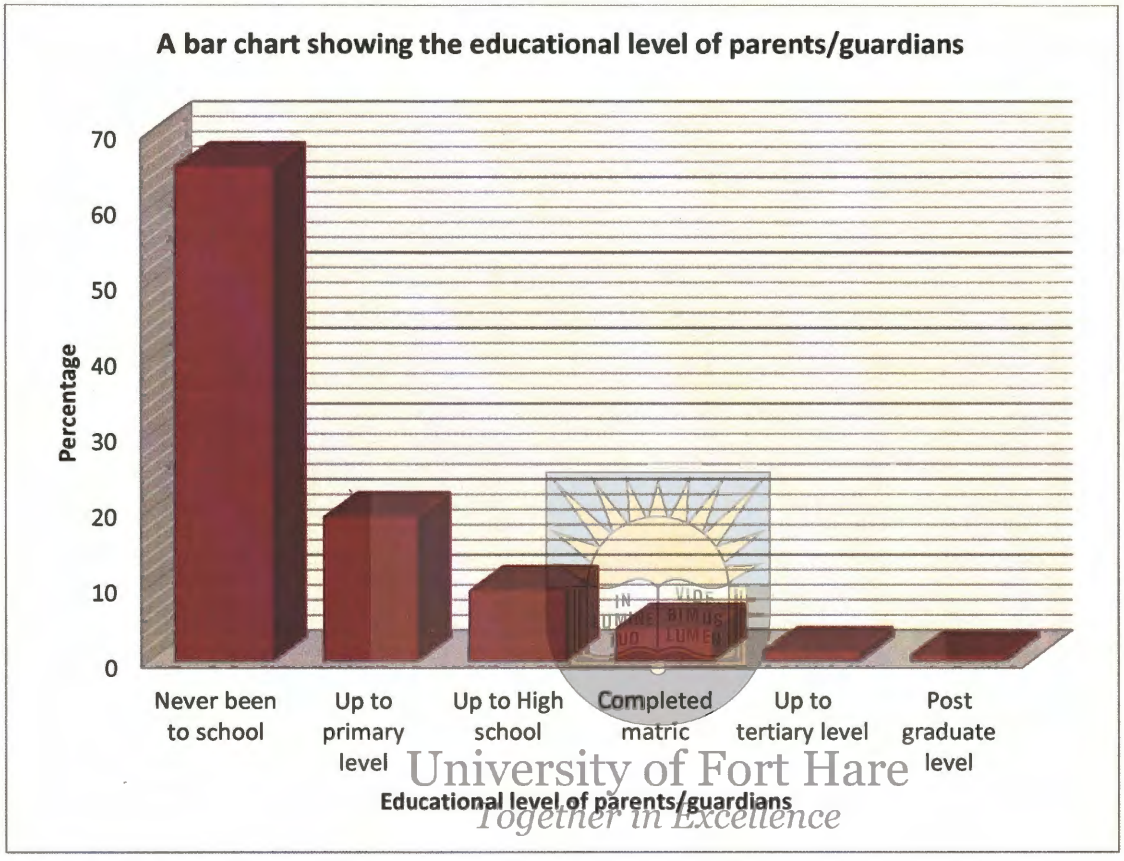
The purpose of this question was for the researcher to ascertain the highest educational level of parents/guardian.

Table 4.6: *The educational level of parents/guardians*

Educational level	No. of learners	Percentage
Never been to school	212	65.4
Up to primary level	62	19.1
Up to high school	30	9.3
Completed matric	14	4.3
Up to tertiary level	4	1.2
Post graduate level	2	0.6
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.7.



Highest educational level of parents/guardians

Source: *Field study (August, 2016)*

From the Table 4.6 and Fig.7, it can be observed that, of the three hundred and twenty-four (324) respondents, two- hundred and twelve (212) translating to 65% of the parents/guardians had never been to school, sixty-two (62) parents/guardians representing 19.1% had up to primary level education, thirty (30) parents/guardians representing (9.3%) had up to high school level education, fourteen (14) parents/guardians translating to 4.3% completed matric, four (4) representing 1.2% had up to tertiary level education and two (2) representing (0.6%) had up to post graduate level of education.

It is very clear that most parents and guardians had never been to school. However, it is obvious that higher education levels of parents/guardians enhance a greater appreciation of education and the ability to assist learners learn mathematics.

Patel & Oke (cited in Cherian & Mau, 2003:33) argue that parents or guardians may be illiterate and therefore cannot provide the necessary scaffolding to support homework. Diaze, Neal & Amaya-Williams (cited in Cherian & Mau, 2003:34) are of the view that unnecessary support can undermine learning by making the learner completely dependent on the educator and so makes it difficult for the educator to withdraw from the situation.

It is a basic responsibility of every parent and guardian to monitor and supervise the homework and learning at home. This supervision and interaction between parents/guardians and their wards' learning at home create a feeling of love and care between the learner, the parent/guardian and the environment as a whole.

However, the educational level of parents from Table 4.9 indicates that most parents/guardians are unlikely to initiate such interactions because they will feel handicapped to do so. A study was conducted by Mbokosi, Msila & Singh, (2004:301) on the effect of black parents' involvement in the success of their children's education. Their study revealed that the black parents' role is crucial in the promotion of academic achievements of their wards. Parents/guardians who neglect their roles in their children's homework and study activities may likely have a negative effect on their children's mathematics performance.

4.3.6 Employment status of parents/guardians

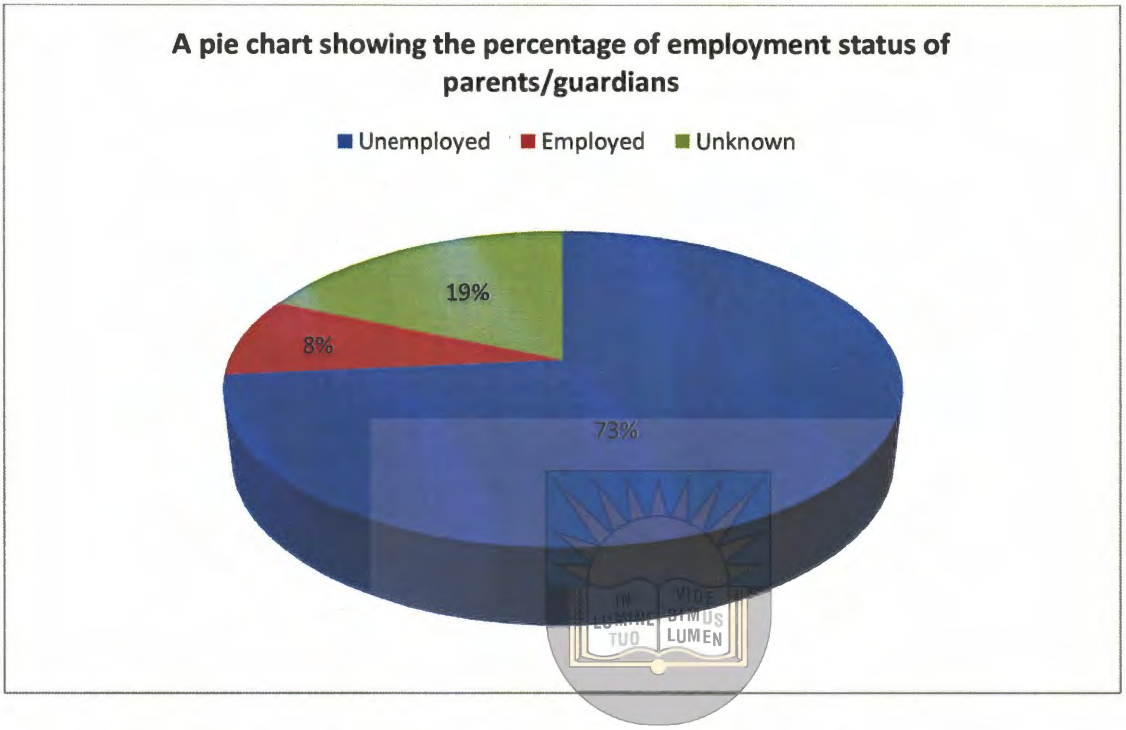
The aim of this question was to find out the employment status of parents/guardians.

Table 4.7: *The employment status of parents/guardians*

Employment status	No. of learners	Percentage
Unemployed	238	73.5
Employed	26	8.0
Unknown	60	18.5
Total	324	100

Source: *Field study (August, 2016)*

Fig.8.



The percentage of employment status of parents/guardians.

Source: *Field study (August, 2016).*

The Table 4.7 and Fig.8, show the employment status of parents/guardians. It can be deduced that two hundred and thirty-eight (238) translating to 73.5% of parents /guardians were unemployed at the time of the survey. Twenty-six (26) representing 8% were employed and sixty (60) translating to 18.5% did not know the employment status of their parents/guardians.

A possible explanation for the "response unknown" could be that the learners did not understand the question or did not know the employment status of the parents/guardians or the learner might be living on his/her own. Based on the information above, the actual percentage of parents/guardians who are employed or who earn income cannot be stated.

However, it is obvious from Fig.8 that there is a high unemployment level among parents/guardians. This high unemployment level of parents/guardians is likely to limit the level of parental support such as paying of school fees, providing stationery and nutrition to their wards. Nonetheless, unemployed parents can still render their

services to their children by supporting them in choosing their future careers and friends, making subject choices and also giving them guidance and counselling.

Howie (2006) found that family socioeconomic status (SES) affects secondary school students' performance in mathematics in South Africa. Research has shown that low socio-economic status negatively influences academic achievement because it prevents students from accessing various educational materials and resources, and creates a distressing atmosphere at home (possible disruptions in parenting or an increased likelihood of family conflicts (Jeynes, 2002). According to (Rammala, 2009), the high level of illiteracy and unemployment among the rural black communities in South Africa are largely due to poverty. However, Considene & Zappala (2002) argue that families where the parents are advantaged socially, educationally and economically foster a high level of achievement in their children's academic performance.

4.3.7. Modes of transport by learners to school

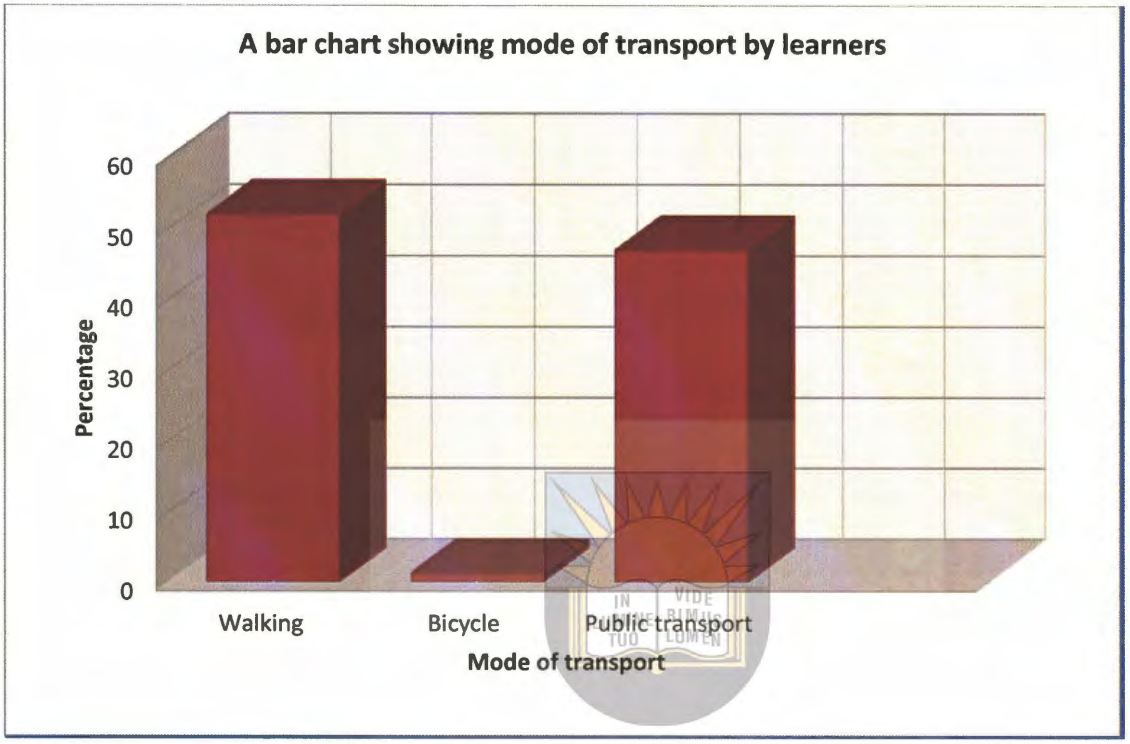
The purpose of this question was to indicate the various modes of transport used by learners to go to school.

Table 4.8: *The mode of transport used by learners to go to school*

Mode of transport	No. of learners	Percentage
Walking	168	51.9
Bicycle	4	1.2
Public transport	152	46.9
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.9.



Percentage of mode of transport used by learners to go to school.

Source: *Field study (August, 2016).*

Table 4.8 shows that one-hundred and sixty-four (164) learners translating to 51.9% walk to school, eight (8) learners representing 1.2% ride on bicycles, and one-hundred and fifty-two (152) respondents translating to 46.9% use public transport. It can be deduced that the majority of the learners walk to school. The explanation for this could possibly be related to the distance of the schools to their homes or locations.

According to Tywakali (2004), the distance compares unfavourably with the average distance for learners in the province, which is 3,5 km. From the research it was observed that attendance at school is often affected when there is unfavourable weather conditions such as a rainstorm or extreme cold since most of the learners walk to school. This eventually leads to absenteeism which contributes to factors affecting poor performance of learners in mathematics.

This assertion is based on Dednam (2005:1999) that regular absence from school and change of schools are two of the most important causes of mathematical difficulties as they cause backlogs in mathematical knowledge. Learners' absenteeism causes a lot of backlogs thus making it very difficult for them to keep pace with work at school.

These backlogs become extremely serious if the educator is not able to offer remedial teaching and also if he/she lacks the technical know-how to find solutions for such learners. Learners who also take public transport to school absent themselves from school if they do not have money for transport.

4.4. QUESTIONNAIRE ON FACTORS AFFECTING LEARNERS' MATHEMATICS PERFORMANCE

4.4.1 What is your attitude towards the subject mathematics?

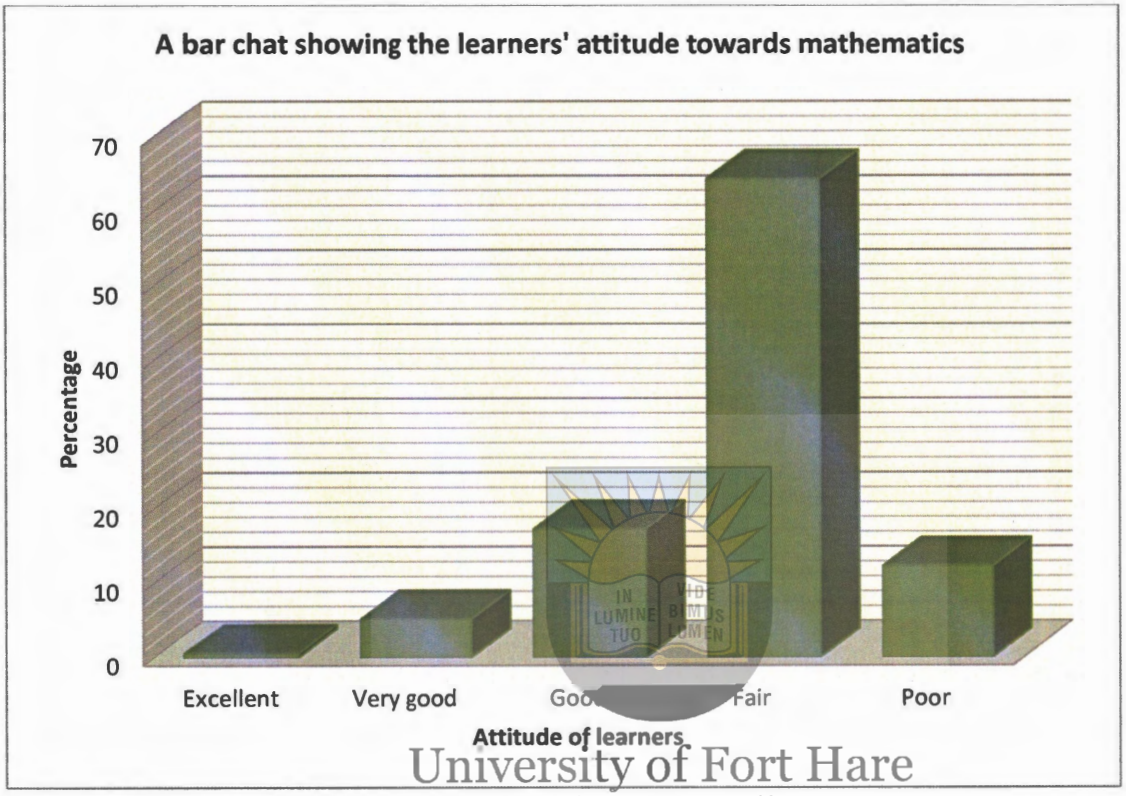
The aim of this question was to find out the attitude learners have towards mathematics.

Table 4.9: *The attitude of learners towards mathematics*

Attitude	No. of learners	Percentage
Excellent	2	0.6
Very good	17	5.2
Good	56	17.3
Fair	209	64.5
Poor	40	12.3
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.10.



The attitude of learners towards mathematics.

Source: *Field study (August, 2016)*

From Table 4.9 and Fig.10, it can be observed that two-hundred and nine (209) learners representing 64.5% have a fair attitude towards mathematics, fifty-six (56) learners translating to 17.3% have a good attitude towards mathematics, forty (40) learners translating to 12.3% have a poor attitude towards mathematics, seventy (17) learners representing 5.2% have very good attitude towards mathematics and two (2) learners representing 0,6% have an excellent attitude towards mathematics.

From the above observation, it is obvious that the majority of the learners do not like mathematics. This is a clear indication that there are some factors impending learners from learning mathematics. It is therefore imperative to remove all impediments affecting learners' mathematics.

In general, a consistent pattern of attitudes towards school subjects and achievement in the respective subjects has been confirmed through a large number

of studies (Papanastasiou, 2002). Many studies have examined students' thinking about school and their attitudes towards mathematics (Vanayan, White, Yuen & Teper, 1977, cited in Papanastasiou, 2000). Papanastasiou (2002) showed that there is a positive relation between mathematics attitudes and math achievement. According to Schereiber (2000), those who have positive attitudes toward mathematics perform better in the subject.

4.4.2 What is your level of understanding when English is used as a medium of instruction in teaching mathematics?

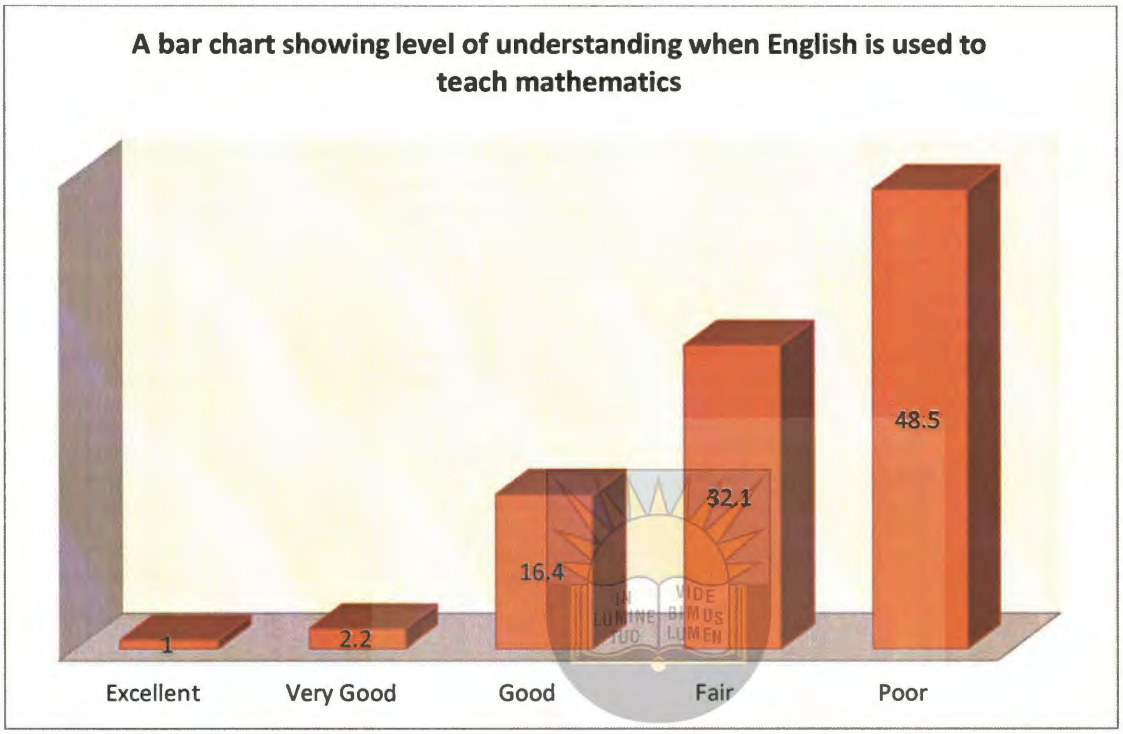
The purpose of this question was to find out the level of learners' understanding when English is used as a medium of instruction in teaching mathematics.

Table 4.10: *The level of understanding of learners when English is used as a medium of instruction*

Level of understanding	No. of learners	Percentage
Excellent	3	1
Very good	7	2.2
Good	53	16.4
Fair	104	32.1
Poor	157	48.5
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.11.



The level of understanding of learners when English is used as a medium of instruction for mathematics.

Source: *Field study (August, 2016)*

From Table 4.10 above it can be observed that one hundred and fifty-seven (157) learners' (representing 48.5%) level of understanding for mathematics when English is used as a medium of instruction is "poor", one hundred and four (104) learners (representing 32.1%) is "fair", fifty-three (53) learners translating to 16.4% is " good" , seven (7) learners' (representing 2.2%) understanding "very good", and three (3) learners' (1%) level of understanding of mathematics when English is used as a medium is "excellent".

Thus it can be deduced that majority of the learners' level of understanding mathematics when English is used as a medium of instruction is "poor". However, mathematics is a universal subject and the questions are written in the universal language. It is therefore imperative for both the educators and learners to equip themselves in the language in which the questions are set.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2008) conducted research across 26 countries showing that over 50 percent of students who dropped out of school did not speak the language in which they were being educated. Kallaway (2002) reveals that, although primary school education for Africans was taught in their mother tongue, much of their secondary education was delivered in either English or Afrikaans.

4.4.3 What is your level of confidence in solving mathematics questions?

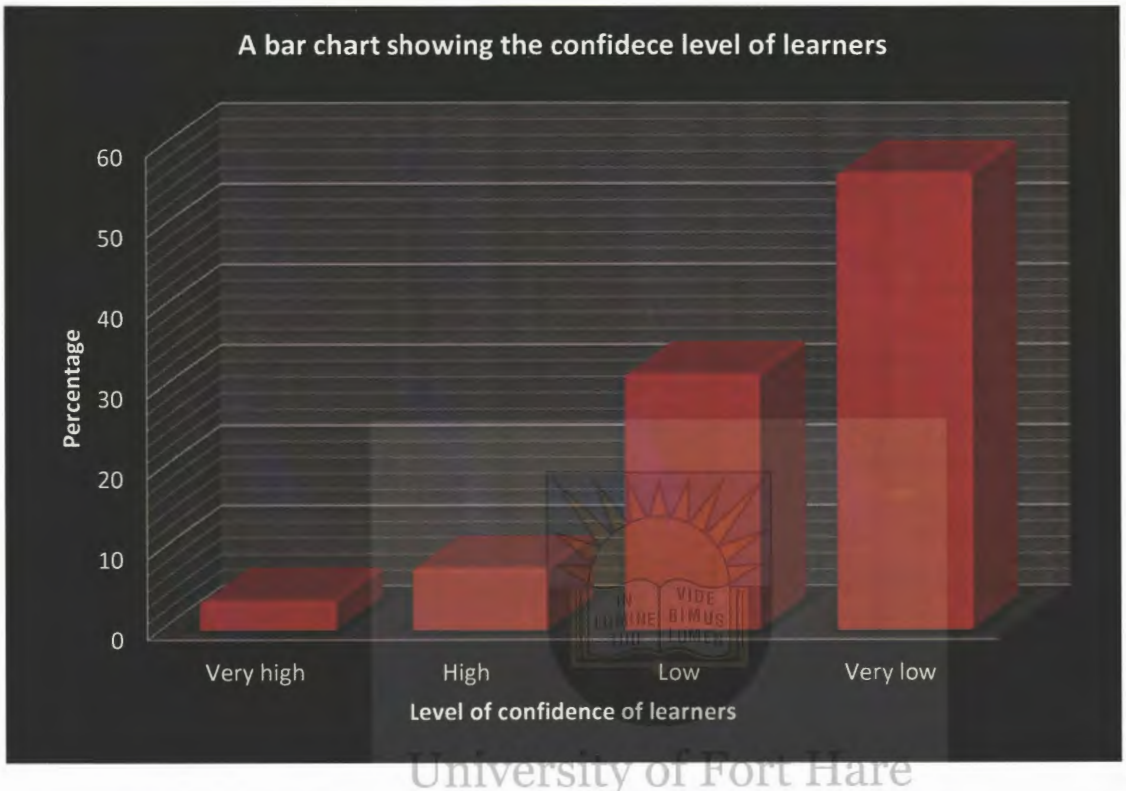
The aim of this question was to access the level of confidence of learners in solving mathematics questions.

Table 4.11: *The confidence level of learners in answering mathematics questions*

Level of confidence	No. of learners	Percentage
Very high	12	3.7
High	25	7.7
Low	103	31.8
Very low	184	56.8
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.12.



The confidence level of learners in answering mathematical questions.

Source: *Field study (August, 2016)*

From Table 4:11 above it can be observed that one hundred and eighty-four (184) learners' (56.7%) level of confidence in solving mathematics is "very low", one hundred and three (103) learners' (31.7%) level is "low", twenty-five (25) learners' (7.7%) level of confidence in solving mathematics questions is "high" and twelve (12) learners' (3.7%) level of confidence is "very high".

It can be deduced from the table above that the majority of the learners' confidence in solving mathematical questions is "very low". This eventually affects the performance of learners in mathematics. .

According to the National Research Council (2000) as cited in Akey (2006), students' beliefs about their competence and their expectations for success in school have been directly linked to their levels of engagement, as well as to emotional states that promote or interfere with their ability to be academically successful. Ashcraft (2002) reveals that learners have a feeling of tension, apprehension, or fear for

mathematics. Ashcraft suggests that highly anxious mathematics students will avoid situations in which they have to perform mathematical calculations. Unfortunately, mathematics avoidance results in less competency, exposure and mathematics practice leaving students more anxious and mathematically unprepared to achieve (Ashcraft, 2002).

4.4.4. How do you evaluate the method used by your mathematics educator in teaching?

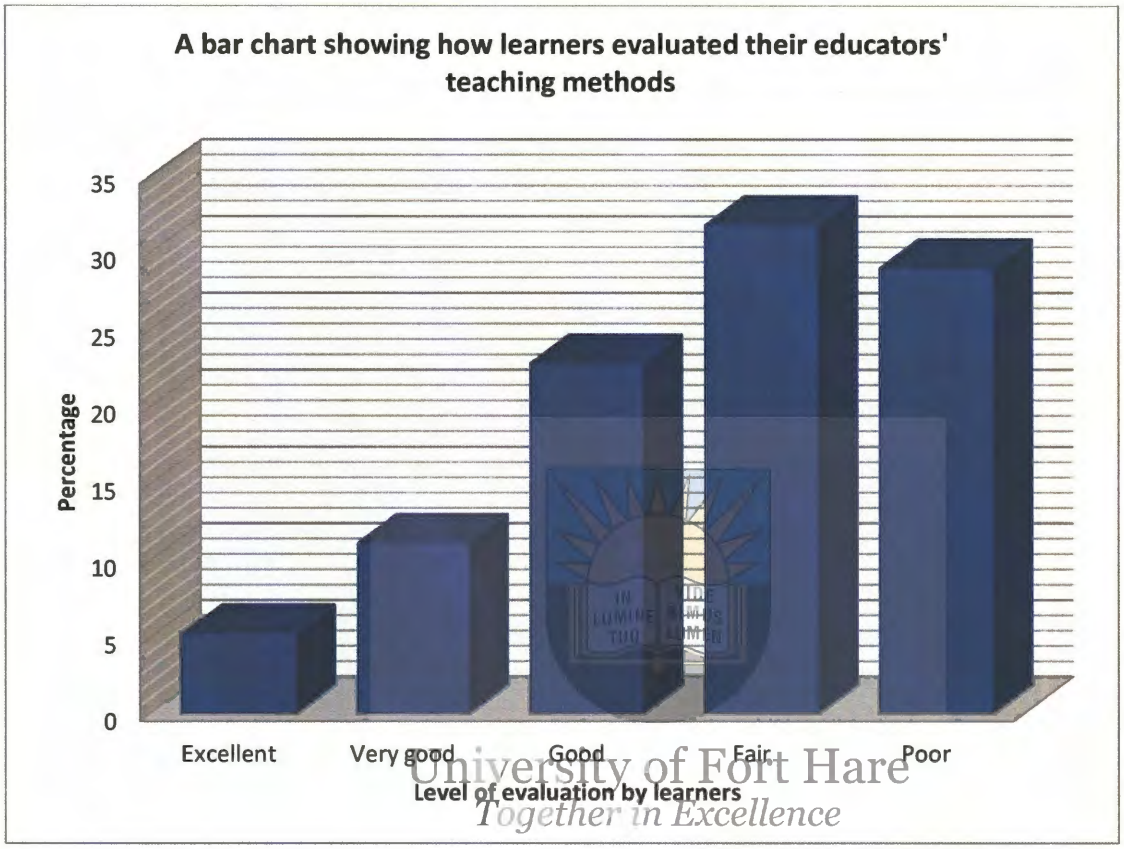
The purpose of this question was to evaluate the method used by the mathematics educator in teaching.

Table 4.12: *How learners evaluate educators' methods of teaching mathematics*

Evaluation	No. of learners	Percentage
Excellent	17	5.2
Very good	36	11.1
Good	74	22.8
Fair	103	31.8
Poor	94	29.0
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.13.



Evaluation of the method used by the mathematics educator.

Source: *Field study (August, 2016)*

From Table 4.12 it can be observed that one-hundred and three (103) learners (31.8%) evaluated the methods the mathematics educator use as "fair", ninety-four (94) learners (29%) evaluated the methods the mathematics educator use as "poor", seventy-four (74) learners (22.8%) evaluated the methods the mathematics educator use as "good", thirty-six (36) learners (11.1%) indicated that the methods are "very good" and seventy (17) learners (5.2%) evaluated them as "excellent".

From the above observations it is clear that majority of the learners are not conversant with the methods the mathematics educator use in teaching mathematics. This might hinder the understanding level of the learners.

Kail & Zolner (2005) argue that with proper instruction normally functioning children acquire these basic mathematical skills and are able to solve more complex

mathematical problems with more sophisticated training. Maher and Davis in Ward (2001:2) emphasise that educators must be able to understand learners' constructions that differ from their own. Educators need to realize that solutions are built from past constructions and therefore will probably differ from their own. They must be willing to accept this diversity as long as it is mathematically valid (Ward, 2001:2).

4.4.5. What is the level of motivation given by your mathematics educator in studying mathematics?

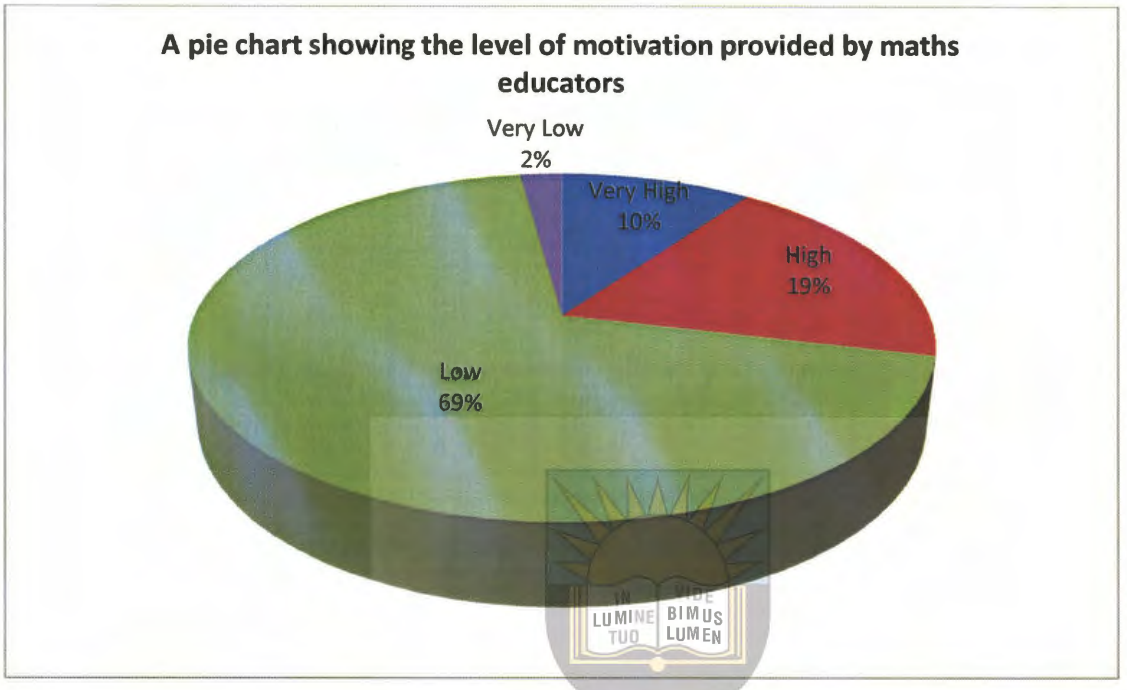
The aim of this question was to determine the level of motivation given by the mathematics educator in studying mathematics.

Table 4.13: *The level of motivation provided by educators to learners*

Level of motivation	No. of learners	Percentage
Very high	18	5.5
High	34	10.5
Low	125	38.6
Very Low	147	45.4
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.14.



The level of motivation provided by mathematics educators

Source: *Field study (August, 2016).*

From Table 4.13, it can be observed that one hundred and forty-seven learners (147) representing 45.4% have "very low" motivation for learning mathematics from their mathematics educators, one hundred and twenty-five (125) learners (38.6%) have "low" motivation for learning mathematics from their mathematics educators, thirty-four (34) learners (10.5%) have "high" motivation and eighteen (18) learners (5.5%) have "very high" motivation for learning mathematics from their mathematics educators.

From the above analysis it is obvious that the mathematics educators do not motivate learners enough to learn mathematics. This might be due to lack of teaching learning materials to make the subject interesting, or low motivation by government to mathematics educators and learners or lack of interest by the educators to teach the subject.

According to Laturner (2002), educators without certification vary in their commitment to the profession depending on coursework preparations. If teachers provide clear

evaluation criteria and individualised corrective feedback on tasks, the students' academic performance improves (Morais, 2002). Educators who adopt behaviourist ways of teaching believe that learners learn by controlling the stimuli, choosing the correct response and providing the appropriate reward (Macleod & Golby, 2003).

4.4.6. How do you evaluate the examples and activities in the grade 9 mathematics textbook?

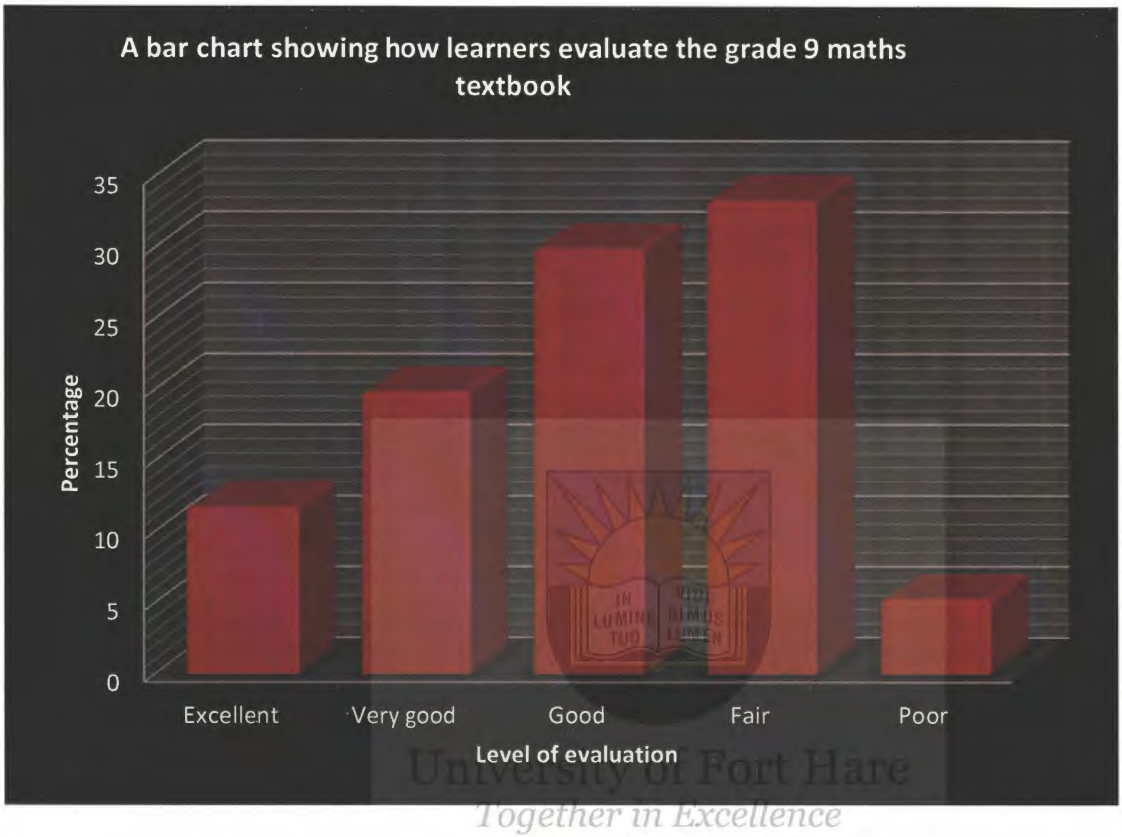
The purpose of this question was to evaluate how learners access the examples and activities in the grade 9 mathematics textbook.

Table 4.14: *How learners evaluate examples and activities in grade 9 mathematics textbook*

Evaluation	No. of learners	Percentage
Excellent	38	11.7
Very good	64	19.8
Good	97	29.9
Fair	108	33.3
Poor	17	5.2
Total	**324**	**100**

Source: *Field study (August, 2016*

Fig.15.



How learners evaluate examples and activities in grade 9 mathematics textbook.

Source: *Field study (August, 2016).*

One-hundred and eight (108) learners representing 33.3% evaluate the examples and activities in the grade 9 mathematics textbook as "fair", ninety-seven (97) learners representing 29.9% evaluated examples and activities in the grade nine mathematics textbook as "good", sixty-four (64) learners (19.8%) evaluated examples and activities in the grade 9 mathematics textbook as "very good", thirty-eight (38) learners (11.7%) evaluated examples and activities as "excellent" and seventeen (17) learners (5.2%) evaluated examples and activities in the grade 9 mathematics textbook as "poor".

The above observation shows clearly that the majority of the learners evaluated the examples and activities in the grade 9 mathematics textbook as "fair" because they are not able to do the activities or might not understand the examples given in the textbook.

According to the Human Sciences Research Council (HSRC), South Africa's growth is stifled by a severe skills shortage, particularly in the fields of science, technology, engineering, mathematics and accounting, and this gap has largely been blamed on the poor quality of the educational system (CDE, 2011)

4.4.7. What is the state of studying mathematics at home after school?

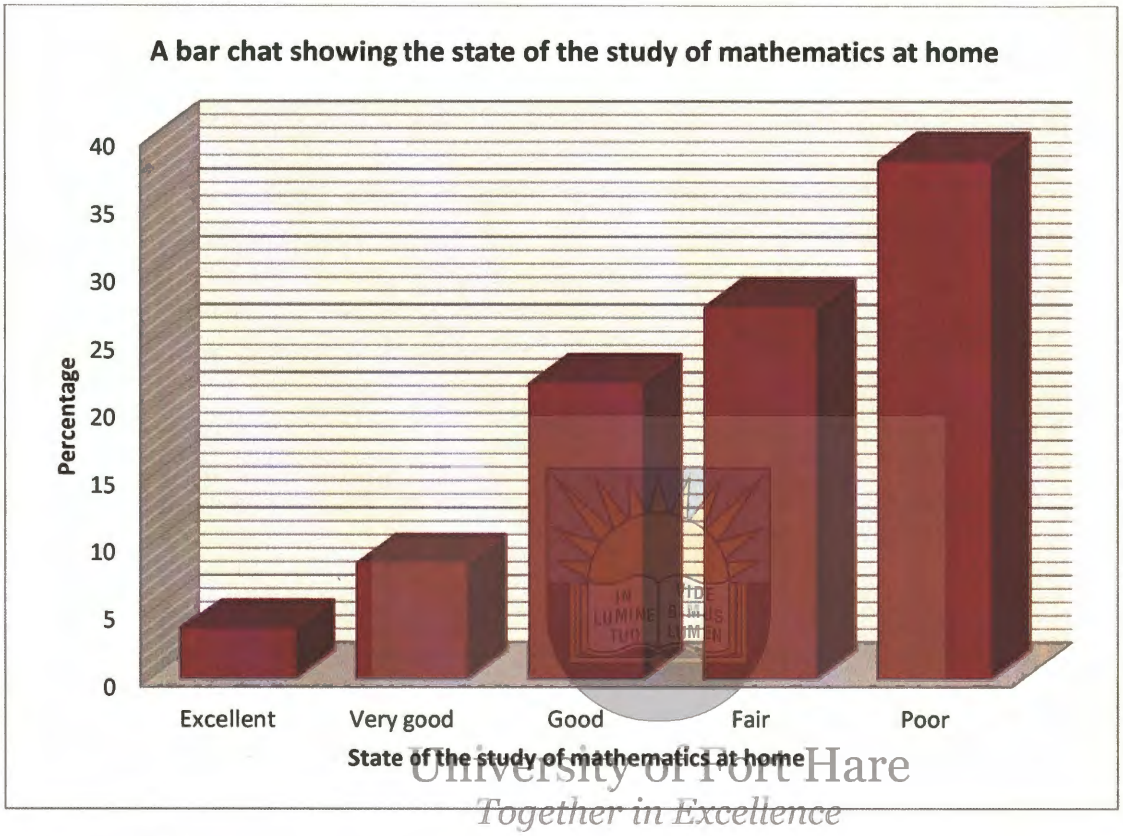
This question was to ascertain the state of the study of mathematics by learners at home.

Table 4.15: *The state of the study of mathematics by learners at home*

State of study	No. of learners	Percentage
Excellent	12	3.7
Very good	28	8.6
Good	71	21.9
Fair	89	27.5
Poor	124	38.3
Total	324	100

Source: *Field study (August, 2016*

Fig.16.



The state of study of mathematics at home after school.

Source: *Field study (August, 2016).*

From table 4.15 above it can be seen that one hundred and twenty-four (124) learners (38.3%) state that their of study of mathematics after school is "poor", eighty-nine (89) learners (27.5%) state that their study of mathematics after school is "fair", seventy-one (71) learners representing 21.9% state that it is "good", twenty-eight (28) learners representing 8.6% say it is "very good" and twelve (12) learners (3.7%) state that their study of mathematics after school is "excellent".

It can be seen clearly from the above analysis that the majority of the learners do not study mathematics at home after school. This might be due to laziness on the part of the learners or the inability to solve mathematical problems on their own or they do not have anybody to assist them at home when faced with difficulties in studying mathematics at home. This eventually leads to poor performance of learners in mathematics. Research has shown that a parents' perception of mathematics

influences their children's perceptions and achievements in mathematics (Yee & Eccles, 1988). The consensus among researchers is that parents and the society can exert a positive influence on their children's mathematical performance (Wamala, Kizito & Jjemba, 2013).

4.4.8 How do you rate the assistance or supervision received from parents/guardians towards the study of mathematics at home?

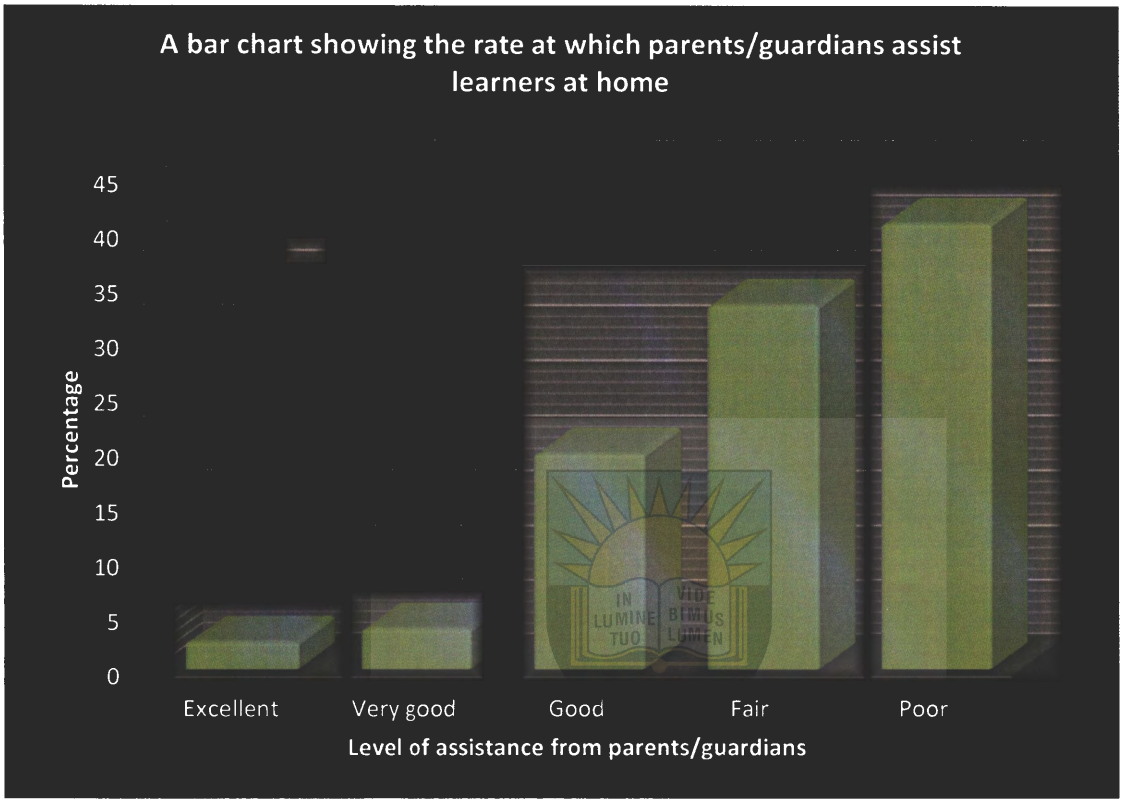
The purpose of this question was to find out the rate at which parents/guardians assist or supervise their wards in the learning of mathematics at home.

Table 4:16: *The rate of parent/guardian assistance to learning of mathematics at home*

Parent/guardian assistance	No. of learners	Percentage
Excellent	8	2.5
Very good	12	3.7
Good	64	19.8
Fair	108	33.3
Poor	132	40.7
Total	**324**	**100**

Source: *Field study (August, 2016)*

Fig.17.



The rate at which parents/guardians assist their children to study mathematics at home.

Source: *Field study (August, 2016)*

Table 4:16 shows that one hundred and thirty-two (132) learners (40.7%) rate the assistance or supervision received from their parents/guardians at home for mathematics as "poor", one hundred and eight (108) learners (33.3%) regard it as "fair", sixty-four (64) learners (19.8%) rate it as "good", twelve (12) learners representing 3.7% rate it as "very good" and eight (8) learners (2.5%) regard the assistance or supervision received from their parents or guardians at home for mathematics as "excellent". From the above analysis it can be observed that the majority of the learners do not get assistance or supervision from their parents/guardians at home for mathematics. This might be due to the fact that the majority of the parents/guardians cannot read or write. It might also be due to the absence of parents/guardians from home or they do not see the need for their children's/wards' education. A student's success in school is increased if his/her

parents are involved in his/her education both at home and school (Henderson & Mapp, 2002). Research has shown that students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education (Campbell, Hombo, & Mazzeo, 2000). Parents' educational levels not only impact student attitudes toward learning but also impact their math achievement scores. The influence of the parents in the meta-cognitive trainings like study habits and achievement pressure can be considered as elements behind school performance (Quimbo, 2003).

4.5 EDUCATORS' QUESTIONNAIRE ANALYSIS

This section deals with responses and analysis of the selected educators teaching grade 9 mathematics. This includes their demographic details and teaching strategies.

4.5.1 The age of the educator

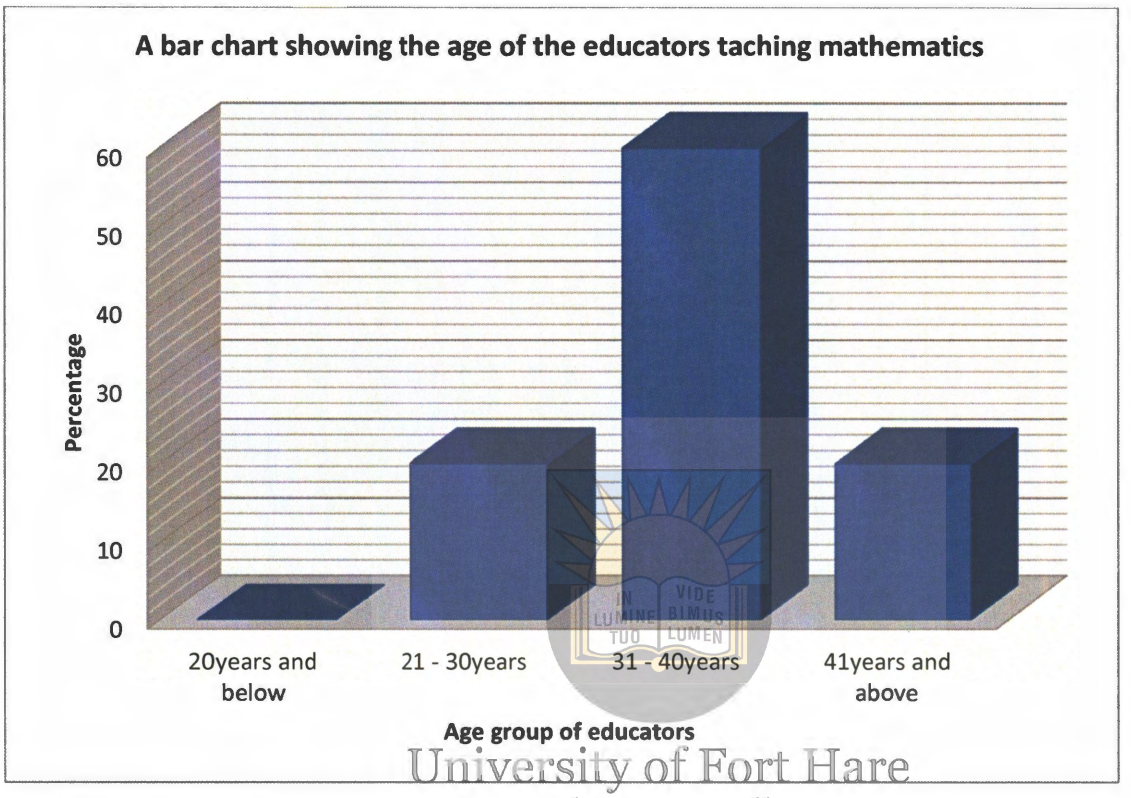
The purpose of this question was to determine the age group distribution of educators teaching grade 9 mathematics.

Table 4:17: *The age distribution of educators teaching grade 9 mathematics*

Age	No. of educators	Percentage
20 years and below	0	0
21 – 30 years	1	20
31 – 40 years	3	60
41 years and above	1	20
Total	**5**	**100**

Source: *Field study (August, 2016)*

Fig.18.



The age distribution of educators teaching grade 9 mathematics.

Source: *Field study (August, 2016)*

From the Fig.18 it can be observed that three (3) educators' (60%) age ranges between 31-40 years, one (1) educator (20%) is between 21 and 30 years, and another educator's (20%) age ranges between 41 years and above. None of the educators is 20 years and below. The above analysis indicates that the majority of the educators teaching grade 9 mathematics ranges between the ages of 31-40 years. However, Ayotola and Adedeji (2009) reported that age has an insignificant negative correlation with mathematics performance.

4.5.2 Sex (Gender classification of educators)

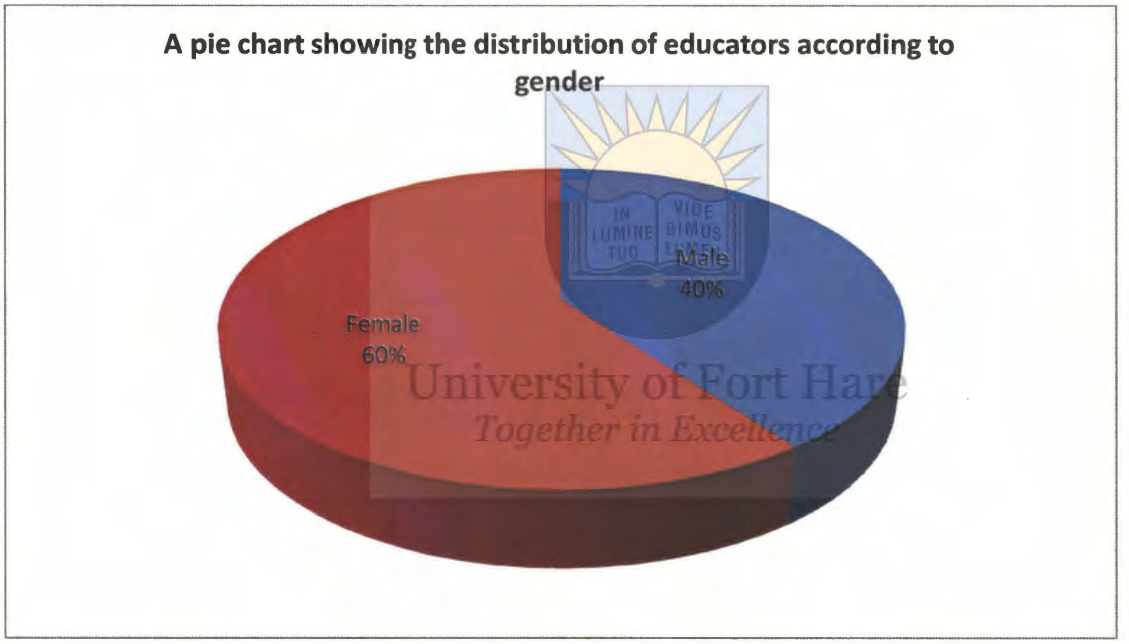
This question was to determine the gender classification of educators teaching grade 9 mathematics.

Table 4:18: *The gender classification of grade 9 educators*

Gender	No. of educators	Percentage
Male	2	40
Female	3	60
Total	5	100

Source: *Field study (August, 2016)*

Fig.19.



The percentage of gender distribution of educators teaching grade 9 mathematics.

Source: *Field study (August, 2016)*

Fig.19 above shows that three (3) educators (60%) are females and two (2) educators (40%) are males. The analysis above clearly indicates that majority of educators teaching grade 9 mathematics at the time of the survey were females.

Johns, Schmader, & Martens (2005) examined the effect of Teaching Stereotype Threat as a means of improving women's mathematics performance. The researchers concluded that women tended to perform worse than men in mathematics equations.

4.5.3 Racial group of educators

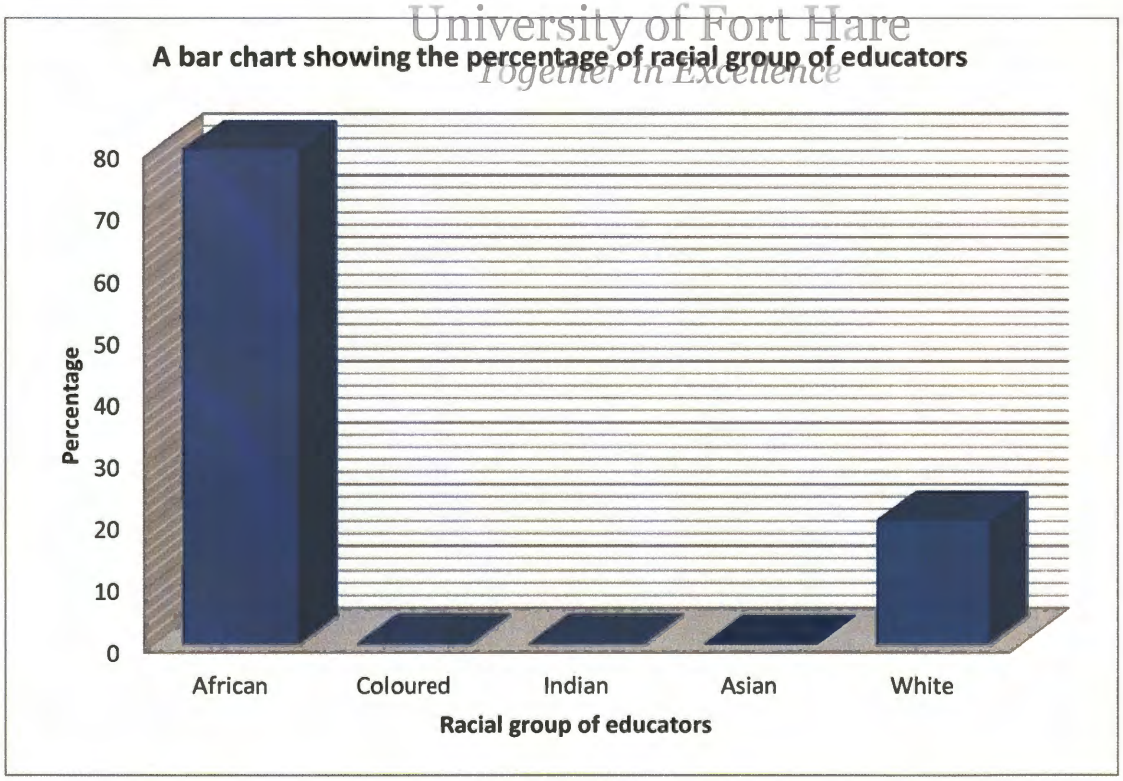
The aim of this question was to determine the racial group of educators teaching grade 9 mathematics.

Table 4:19: *The racial breakdown of educators teaching grade 9 mathematics*

Race	No. of educators	Percentage
African	4	80
Coloured	0	0
Indian	0	0
Asian	0	0
White	1	20
Total	5	100

Source: *Field study (August, 2016)*

Fig.20.



The racial breakdown of educators teaching grade 9 mathematics.

Source: *Field study (August, 2016).*

From Fig.20 above it can be observed that four (4) educators (80%) are African, one (1) educator (20%) is a white. There were no coloured, Indian and Asian educators teaching grade 9 mathematics in the schools visited as at the time of the survey. It can therefore be observed from the analysis above that majority of the educators teaching mathematics in grade 9 were African as at the time of the survey.

Most Africans, especially the black race, perceive mathematics as a subject reserved for the white race (Christine in Maree, 2007). The only variation is often reflected by the difference in socio-cultural background (Sauian, 2004:2). There are differences in the level of mathematics education of the different countries. Each country has perhaps different cross-cultural heritage, different medium of instruction, different level of educator training as well as different socio-economic positions (Sauian, 2004:3).

4.5.4 Highest educational level of educators

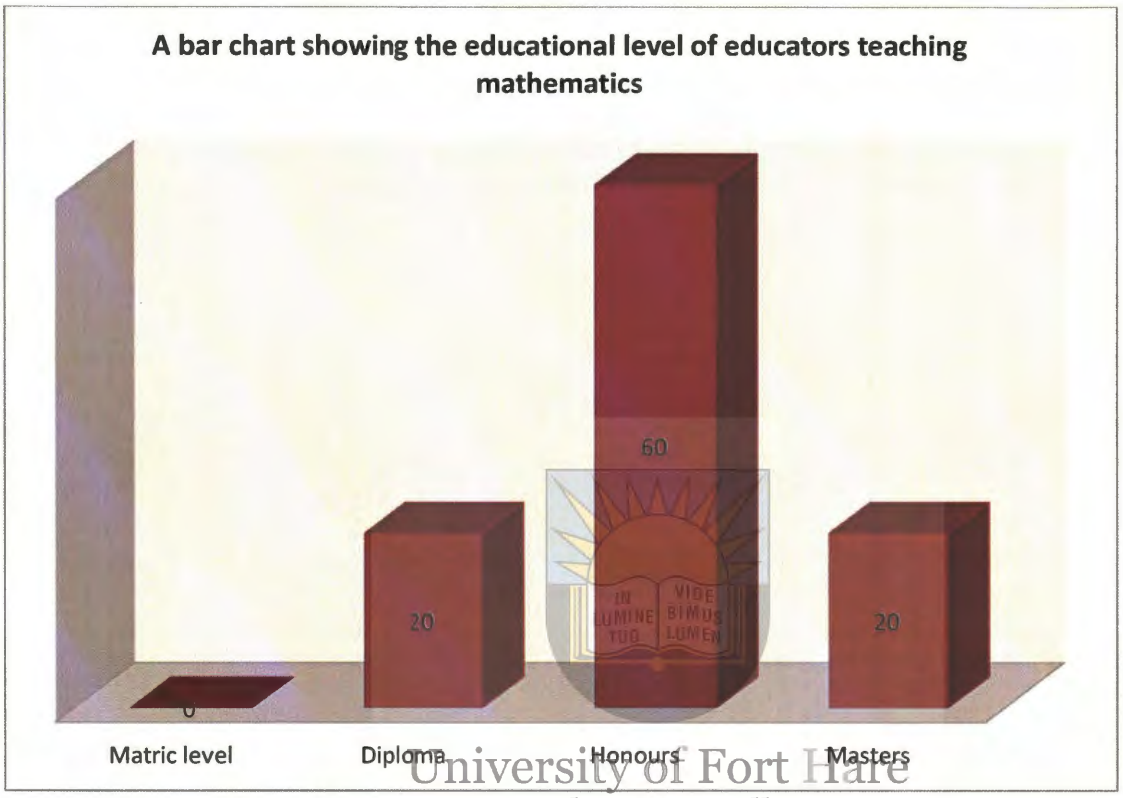
This question was to investigate the highest educational level of the educators teaching grade 9 mathematics.

Table 4:20: *The highest educational level of educators teaching grade 9 mathematics.*

Qualification	No. of educators	Percentage
Matric level	**0**	**0**
Diploma	**1**	**20**
Honours	**3**	**60**
Masters	**1**	**20**
Total	**5**	**100**

Source: *Field study (August, 2016)*

Fig.21.



The percentage of the highest educational level of educators teaching grade 9 mathematics.

Source: *Field study (August, 2016)*

Fig.21 above shows that three (3) educators (60%) have an Honours qualification, one (1) educator (20%) has a Masters qualification, and another educator representing 20% has a Diploma qualification. None of the educators has a Matric level qualification at the schools visited as at the time of the survey. The analysis above shows clearly that majority of the educators have Honours qualifications. Except one educator who has a Masters qualification and another Diploma qualification. It is therefore refreshing to know that all the educators have reached the highest educational level in their academic career.

However, a mathematics audit report reveals that more than 50% of mathematics educators have had no formal subject training (Education For All, 2000). Studies have shown that teachers with certification in mathematics are more likely to be passionate and committed about teaching mathematics than those without

certification. Those without certification vary in their commitment to the profession depending on coursework preparations (Laturner, 2002).

4.5.5 Major subjects studied by the educators

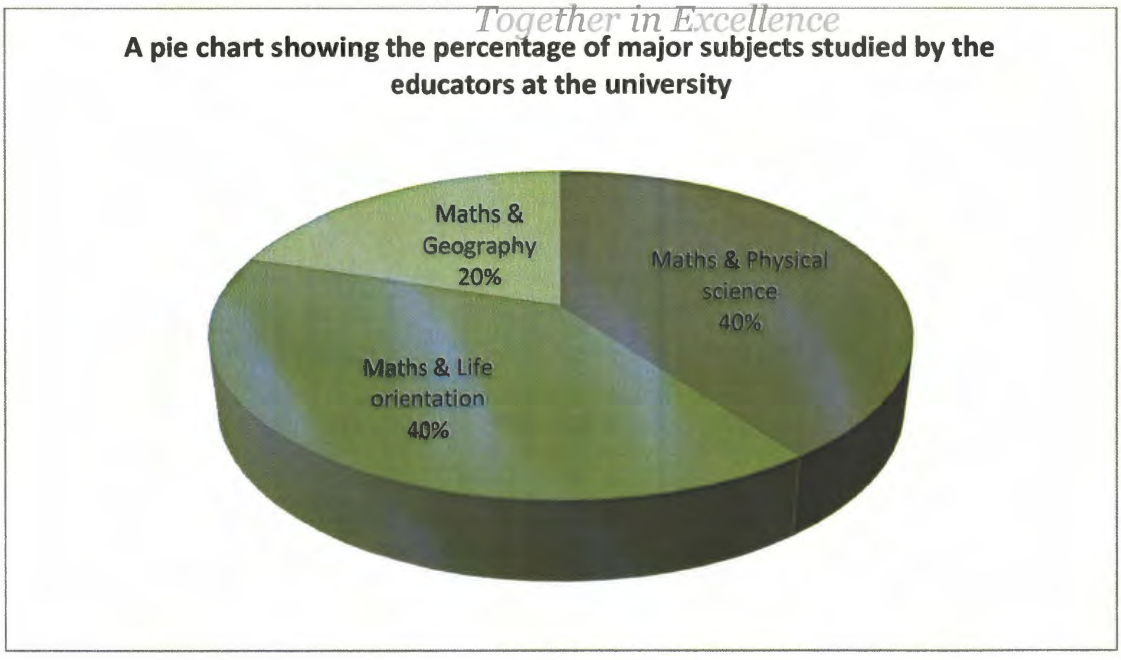
The aim of this question was to find out the major subjects studied by the educators at their various universities.

Table 4:21: *The major subjects study by the educators at their university*

Major subjects	No. of educators	Percentage
Maths & physical science	2	40
Maths & life orientation	2	40
Maths & geography	1	20
Total	5	100

Source: *Field study (August, 2016)*

Fig.22.



Percentage of major subjects studied by the educators at the university.

Source: *Field study (August, 2016).*

From fig.22, it can be observed that two (2) educators (40%) studied mathematics and physical science, two (2) educators (40%) studied mathematics and life orientation, and one (1) educator (20%) studied mathematics and geography. From the above it can be deduced that all the educators studied mathematics at their highest educational level. The Education For All (2000) assessment (2005) reported that, in spite of approximately 85% of mathematics educators being professionally qualified, only 50% have specialized in mathematics in their training (DoE, 2001a).

4.5.6 Number of years teaching grade 9 mathematics

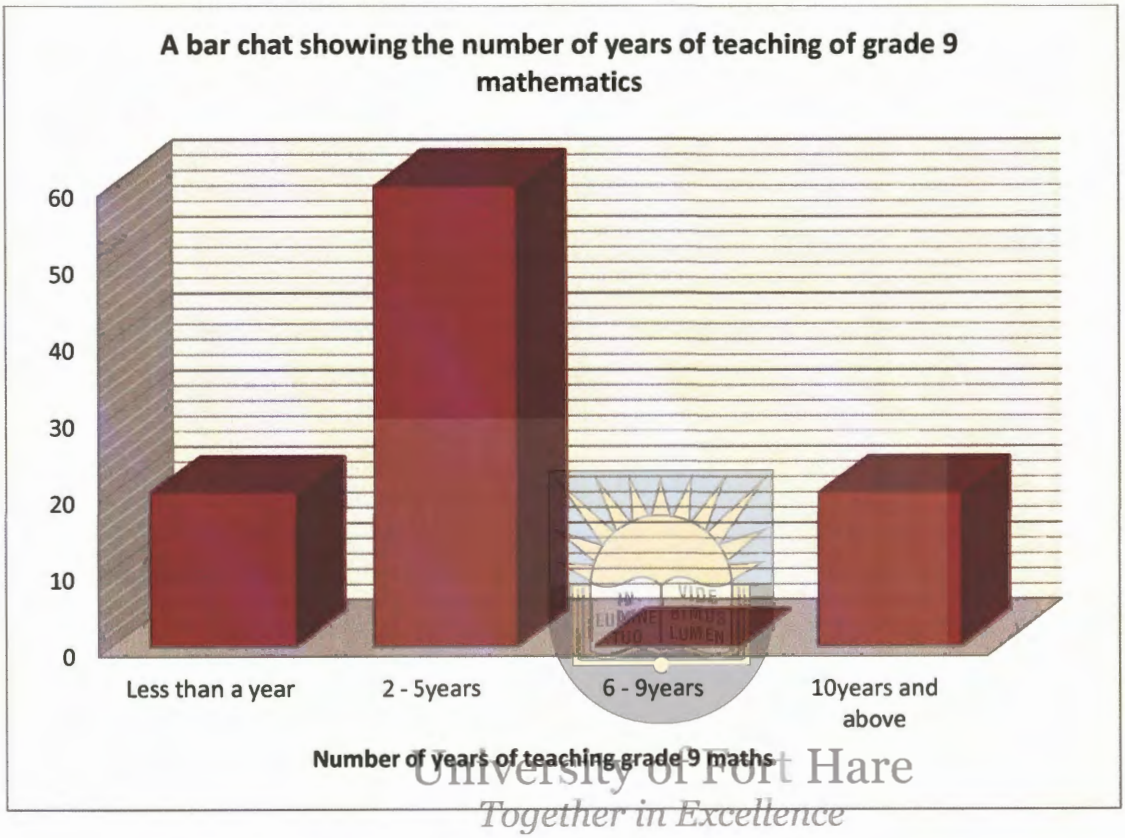
The aim of this question was to determine the number of years the educators had been teaching mathematics in grade 9.

Table 4.22: *The number of years the educators had been teaching mathematics in grade 9*

No. of years	No. of educators	Percentage
Less than a year	1	20
2 – 5 years	3	60
6 – 9 years	0	0
10 years and above	1	20
Total	**5**	**100**

Source: *Field study (August, 2016).*

Fig.23.



The number of years the educators had been teaching mathematics in grade 9.

Source: *Field study (August, 2016)*

Three (3) educators (60%) had been teaching mathematics in grade 9 for 2-5years, one (1) educator (20%) had been teaching mathematics in grade 9 for more than 10 years, while another educator representing 20% had been teaching mathematics in grade 9 for less than a year. None of the educators had taught mathematics in grade nine for 6-9years. It can be deduced from the above analysis that the majority of the educators had been teaching mathematics in grade 9 for more than a year except for one educator who had taught mathematics in grade 9 for less than a year. Bransford, Brown, & Cocking (2000) assert that teachers not only need knowledge of a particular subject matter but also need to have pedagogical knowledge and knowledge of their students.

4.5.7 Number of in-service training sessions attended

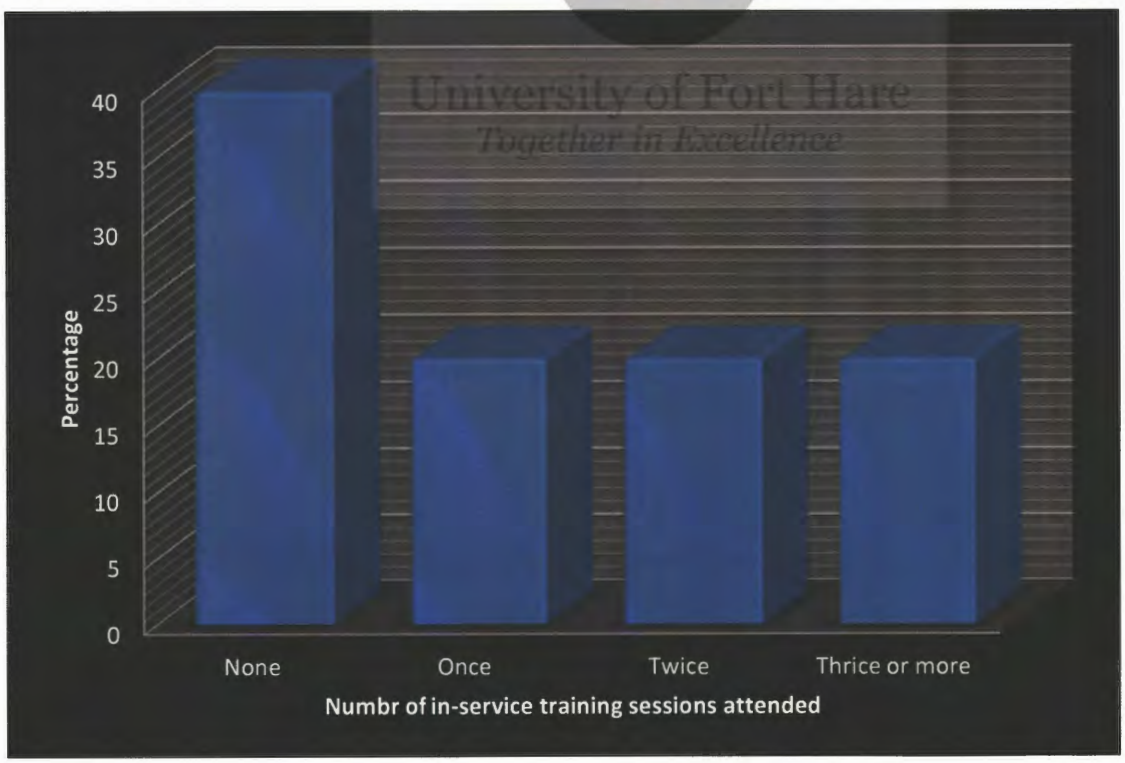
The aim of this question was to find out the number of in-service training sessions attended in mathematics by the mathematics educators in a year.

Table 4.23: *The number of in-service training sessions attended in mathematics by the mathematics educators*

No. of in-service sessions	No. of educators	Percentage
None	2	40
Once	1	20
Twice	1	20
Thrice or more	1	20
Total	5	100

Source: *Field study (August,2016)*

Fig.24.



The number of in-service training sessions attended by mathematics educators.

Source: *Field study (August, 2016).*

Table 4.23 shows that two (2) educators representing 40% had never attended any in-service training in mathematics in a year, while one (1) educator (20%) had

attended in-service training on mathematics once, and one (1) other educator (20%) attended in-service training on mathematics twice in a year. Another educator (20%) also attended in-service training on mathematics more than three times in a year.

From the analysis above, it is clear that two of the educators have not attended any in-service training on mathematics in a year at the time of the survey. This, however, impedes the teaching and learning of mathematics since no innovation is brought to the mathematics classroom. GMMDU (2013) has organised a series of training sessions and workshops in order to equip teachers to handle mathematics with skill and to tap into modern learners' natural affinity for all things technological.

4.5.8 How do you evaluate the in-service training attended in mathematics?

The purpose of this question was to determine how educators assess the in-service training organised for mathematics educators.

Table 4.24: *How educators evaluate in-service training attended*

Evaluations	No. of educators	Percentage
Excellent	0	0
Very good	1	20
Good	1	20
Fair	1	20
Poor	0	0
Total	**3**	**60**

Source: *Field study (August, 2016)*

Fig.25.

How mathematics educators evaluated the in-service training attended.

Source: *Field study (August, 2016)*

Table 4.24 shows that one(1) educator representing 20% evaluated the in-service training attended on mathematics as "very good", one(1) other educator (20%) evaluated the in-service training attended as "good", another educator (20%) evaluated the in-service training as "fair". However, two (2) educators (40%) did not state anything.

This might be due to the fact that they had never attended any in-service training in mathematics as at the time of the survey so they could not evaluate the impact it had on the teaching and learning of mathematics. An upgrading programme was also introduced to focus on upgrading the knowledge competences and skills of under qualified and unqualified educators already in the system (DoE, 2001).

4.5.9 How do you evaluate yourself in the teaching of mathematics?

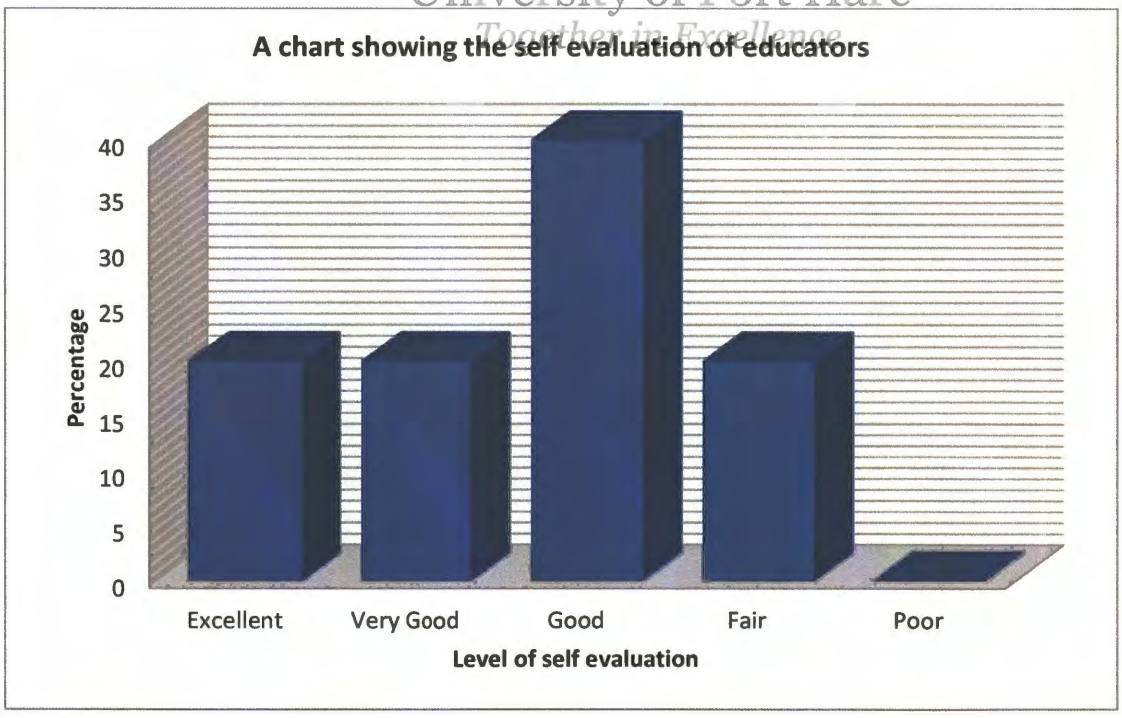
The aim of this question was to determine how educators evaluate themselves in the teaching of grade 9 mathematics.

Table 4.25: *How educators evaluate themselves in the teaching of grade 9 mathematics*

Evaluation	No. of educators	Percentage
Excellent	1	20
Very Good	1	20
Good	2	40
Fair	1	20
Poor	0	0
Total	5	100

Source: *Field study (August, 2016)*

Fig. 26.



How mathematics educators evaluated themselves.

Source: *Field study (August, 2016)*

From the above Table 4.25, it can be observed that two (2) educators (40%) evaluated themselves in the teaching of grade 9 mathematics as "good", one (1)

educator (20%) evaluated himself/herself as "excellent", one other educator (20%) evaluated himself/herself "very good" in the teaching and learning of mathematics while one (1) educator (20%) evaluated his/her teaching of grade 9 mathematics as "fair".

From the above analysis, it is clear that the majority of the educators have some level of confidence in teaching grade 9 mathematics except one educator who has a low level of confidence. This might be due to lack of knowledge of basic mathematical concepts or he/she might not be conversant with the grade 9 mathematics syllabus.

Goulding, Rowland, and Barber (2002) suggest that there are linkages between a teacher's lack of subject knowledge and ability to plan teaching materials effectively. These findings suggest that teachers that do not have sufficient background knowledge in mathematics may struggle with the development of comprehensive lesson plans for their students.

Teacher competency in these areas is closely linked to student thinking, understanding and learning in mathematics education. There is no doubt that student achievement in mathematics education requires teachers to have a firm understanding of the subject domain and the epistemology that guides mathematics education (Ball, 1993; Grossman et al., 1989; Rosebery et al., 1992) as well as an equally meticulous understanding of different kinds of instructional activities that promote student achievement.

4.5.10 How do you evaluate the teaching and learning materials for mathematics?

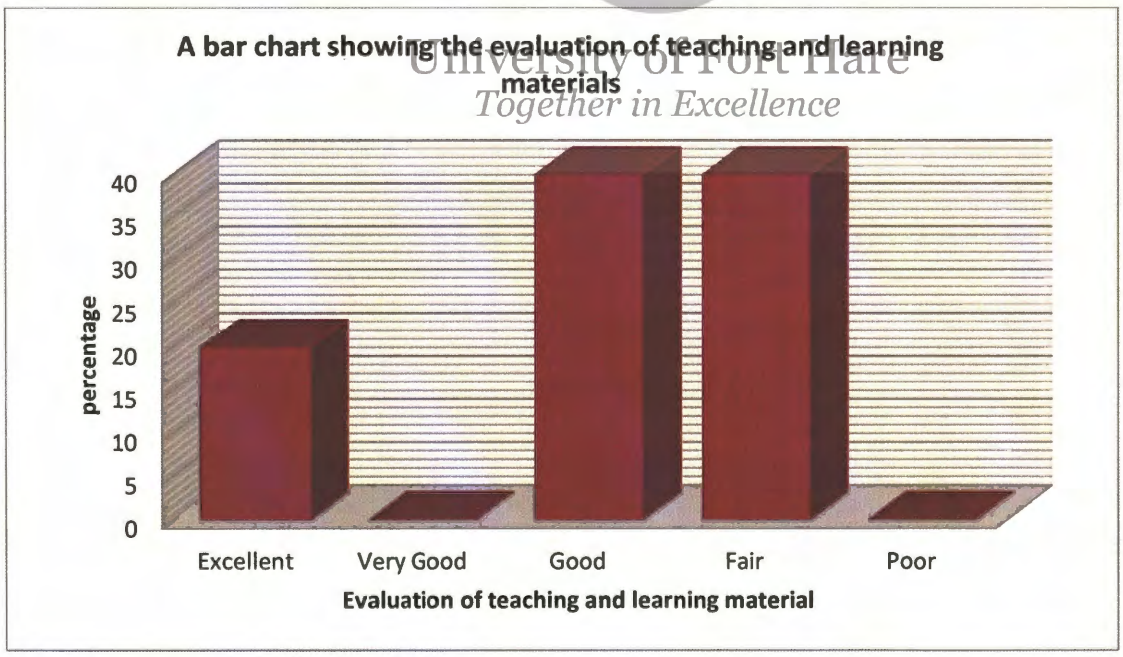
The purpose of this question was to find out how educators evaluate the teaching and learning materials for teaching grade 9 mathematics.

Table 4.26: *How educators evaluate the teaching and learning materials for mathematics in grade 9*

Evaluations	No. of educators	Percentage
Excellent	1	20
Very Good	0	0
Good	2	40
Fair	2	40
Poor	0	0
Total	5	100

Source: *Field study (August, 2016)*

Fig.27.



How educators evaluate the teaching and learning materials for mathematics in grade 9

Source: *Field study (August, 2016)*

Table 4.26 above indicates that two (2) educators representing 40% evaluated the teaching and learning materials for teaching grade 9 mathematics as "good", another

two (2) educators representing 40% evaluated the teaching and learning materials for teaching grade 9 mathematics as "fair", while one (1) educator (20%) evaluated the teaching and learning materials as "excellent". None of the educators indicated that the teaching learning material is "very good" or "poor".

However, from the analysis above, it can be deduced that some of the educators are not satisfied with the teaching and learning materials available for teaching grade 9 mathematics. Rumberger and Palardy (2004) refer to school processes as the teaching practices and social and/or academic climate of schools among other features. In Flanders, an example of an educational system with tracking (Opdenakker and Van Damme, 2001) showed that school composition and school processes jointly explain a sizeable amount of student variance in mathematics achievement at the end of seventh grade.

4.5.11. How do you rate motivation provided by government to educators teaching mathematics?

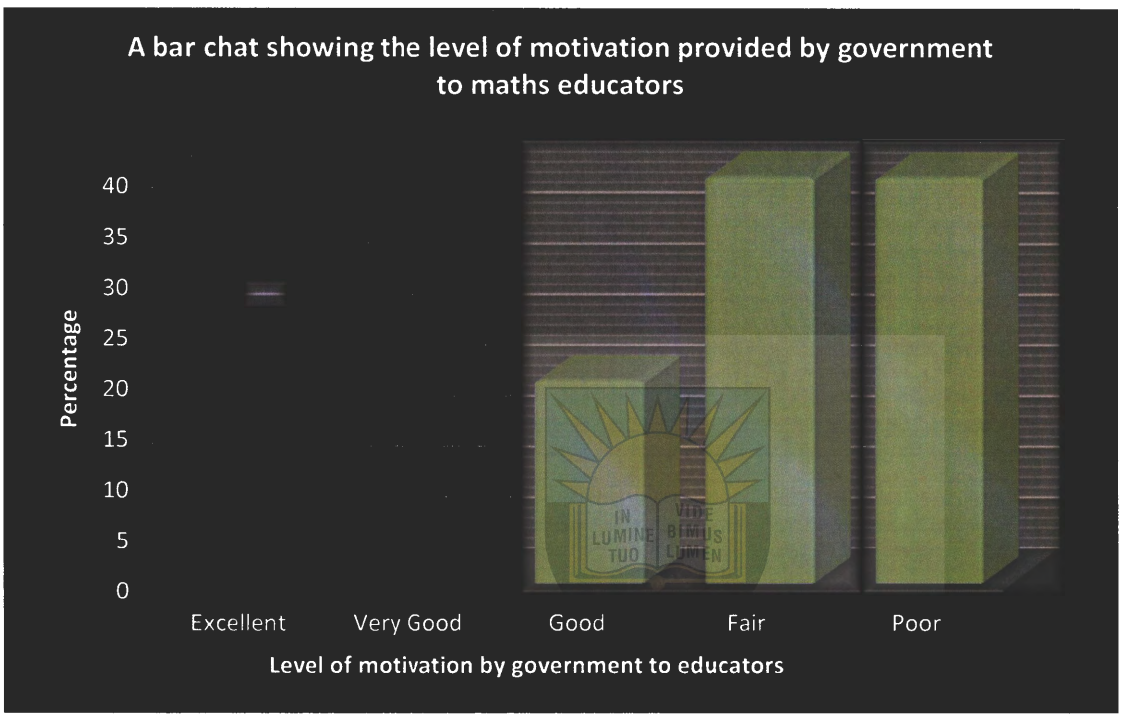
This question aimed to find out how educators teaching grade 9 mathematics evaluate the motivation given to them by government.

Table 4.27: *How educators rate motivation by government to mathematics educators*

Rate of motivation	No. of educators	Percentage
Excellent	**0**	**0**
Very Good	**0**	**0**
Good	**1**	**20**
Fair	**2**	**40**
Poor	**2**	**40**
Total	**5**	**100**

Source: *Field study (August, 2016)*

Fig.28.



The level of motivation provided by government to educators.

Source: *Field study (August, 2016)*

From Table 4.27 it can be observed that two (2) educators representing 40% rated the motivation given to educators teaching grade 9 mathematics by government as "fair", another two (2) educators (40%) also rated the motivation given to educators teaching grade 9 mathematics by government as "poor", and one (1) educator representing 20% rated the motivation given to educators teaching grade 9 mathematics as "good".

The above analysis shows clearly that majority of educators teaching grade 9 mathematics are not pleased with the motivation received from government. The government has introduced NCS for grades R to 12 to provide clearer specification of what is to be taught and learnt on a term-by-term basis across the country (NCS, 2012).

However, the salaries and benefits of teachers do not reflect society's recognition of the profession as one that needs complex skills and knowledge (Cherian & Mau,

2003:170). The South African Democratic Teachers Union (SADTU) observed that the retrenchment of temporary teachers in the Eastern Cape Department of Education has left permanent teachers overworked. The Union stated that some teachers who normally worked about 26-and-a-half hours a week were now forced to work more than 35 hours a week (SADTU, 2012). Teachers are also faced with the problem of working in an overcrowded and poorly equipped classroom (Mji & Makgato, 2006:254).

4.5.12. How do you rate your encouragement to learners to use different methods in solving mathematical problems?

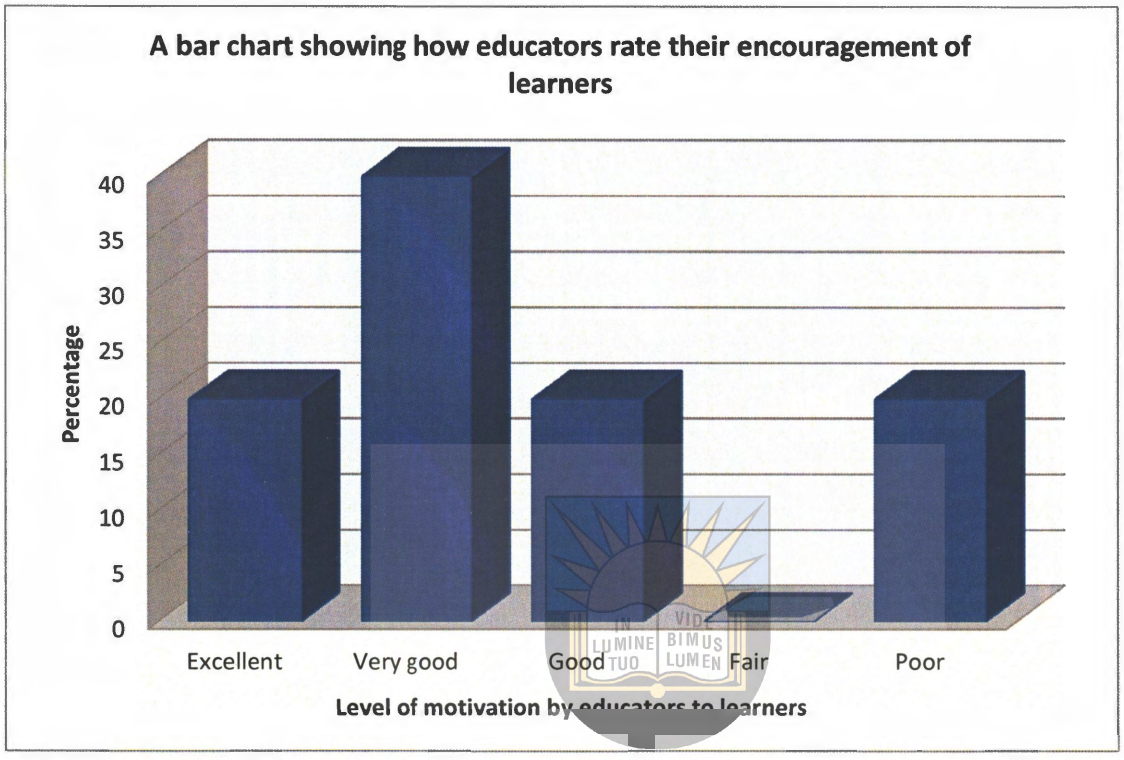
The researcher's purpose for this question was to determine how educators encourage their learners to use different methods in solving mathematical problems.

Table 4:28: *The rate at which educators encourage learners to use different methods in solving maths problems*

Rate of encouragement	No. of educators	Percentage
Excellent	1	20
Very good	2	40
Good	1	20
Fair	0	0
Poor	1	20
Total	5	100

Source: *Field study (August, 2016)*

Fig.29.



How educators rate their encouragement given to their learners.

Source: *Field study (August, 2016)*

Table 4:28 shows that two (2) educators' (40%) encouragement of learners to use different methods in solving mathematical problems is "very good", one (1) educator representing 20% indicated that his/her encouragement to learners to use other methods in solving mathematical problem is "excellent", another educator also representing 20% stated that his/her encouragement to learners to use different approaches in solving mathematical problems is "good" while another educator (20%) indicated that his/her encouragement to learners to use other methods in solving a mathematical problem is "poor".

The above analysis shows clearly that some educators do not encourage their learners to adopt other methods in solving mathematical problems. The learning environment is a major factor in the mastery goals that students set (Kaplan & Maehr, 2007). For example, the degree to which students are motivated appears to be related to teachers' interest in and respect for their students, along with how the teachers enforce discipline. The more democratic the school environment, the more

students are motivated by internal goals and the process of learning (Vedder-Weiss & Fortus, 2011, 2012).

4.5.13: What is your preferred medium of instruction used in teaching mathematics?

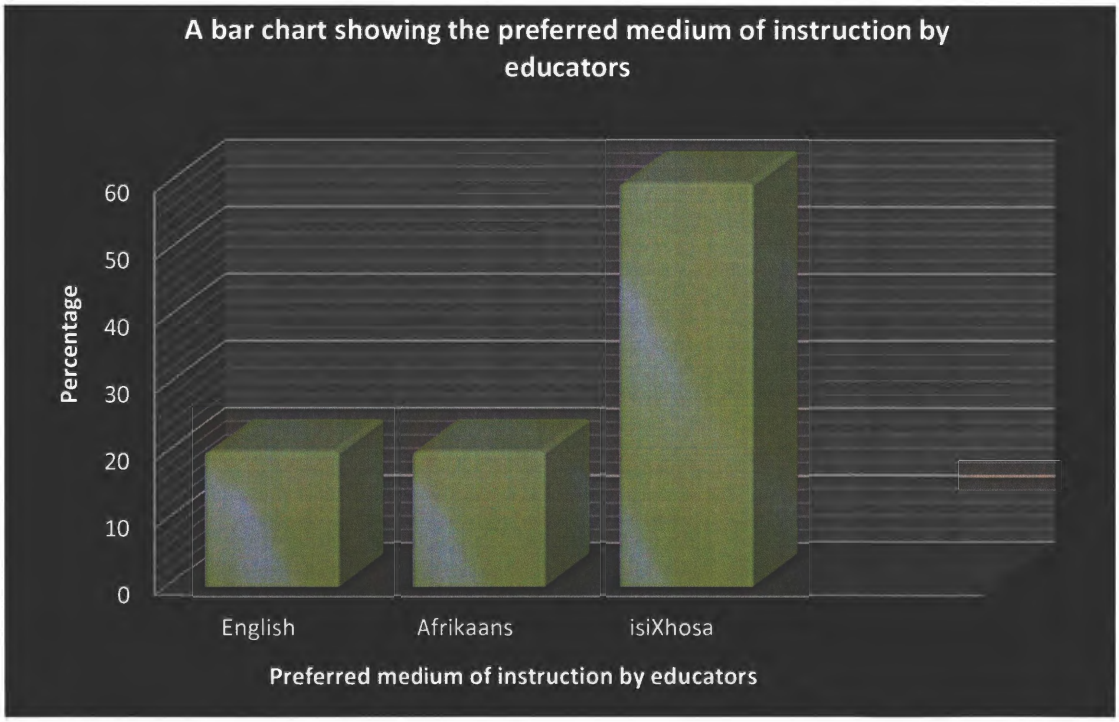
The purpose of this question was to find out the medium of instruction educators prefer using in teaching mathematics.

Table 4:29: *The preferred medium of instruction by educators for teaching mathematics*

Medium of instruction	No. of educators	Percentage
English	1	20
Afrikaans	1	20
isiXhosa	3	60
Total	5	100

Source: *Field study (August, 2016)*

Fig.30.



The preferred medium of instruction by educators teaching mathematics.

Source: *Field study (August, 2016)*

Table 4:29 above shows three (3) educators representing 60% preferred using isiXhosa as the medium of instruction for mathematics, one (1) educator representing 20% preferred using Afrikaans as the medium of instruction for mathematics, and another educator representing 20% preferred using English.

From the above analysis, it is clear that majority of the educators prefer using isiXhosa as the medium of instruction for mathematics. One educator explained that "it is very difficult for the learners to understand topics like financial mathematics when English language is used as a medium of instruction" (educators own word). Another educator stated that "he/she preferred Afrikaans as a medium of instruction for mathematics because" it is my home language and I was taught mathematics in Afrikaans, just easier to express myself" (educator's own word). Research has shown that over 50 percent of students who dropped out of school did not speak the language in which they were being educated (UNESCO, 2008).

The researcher is of the view that mathematics instruction should be in the English language since it is a universal language and most of the mathematics questions are in English.

4.5.14: If your preferred medium of instruction (above) is different from the one being used in the school, how do you evaluate your medium of instruction?

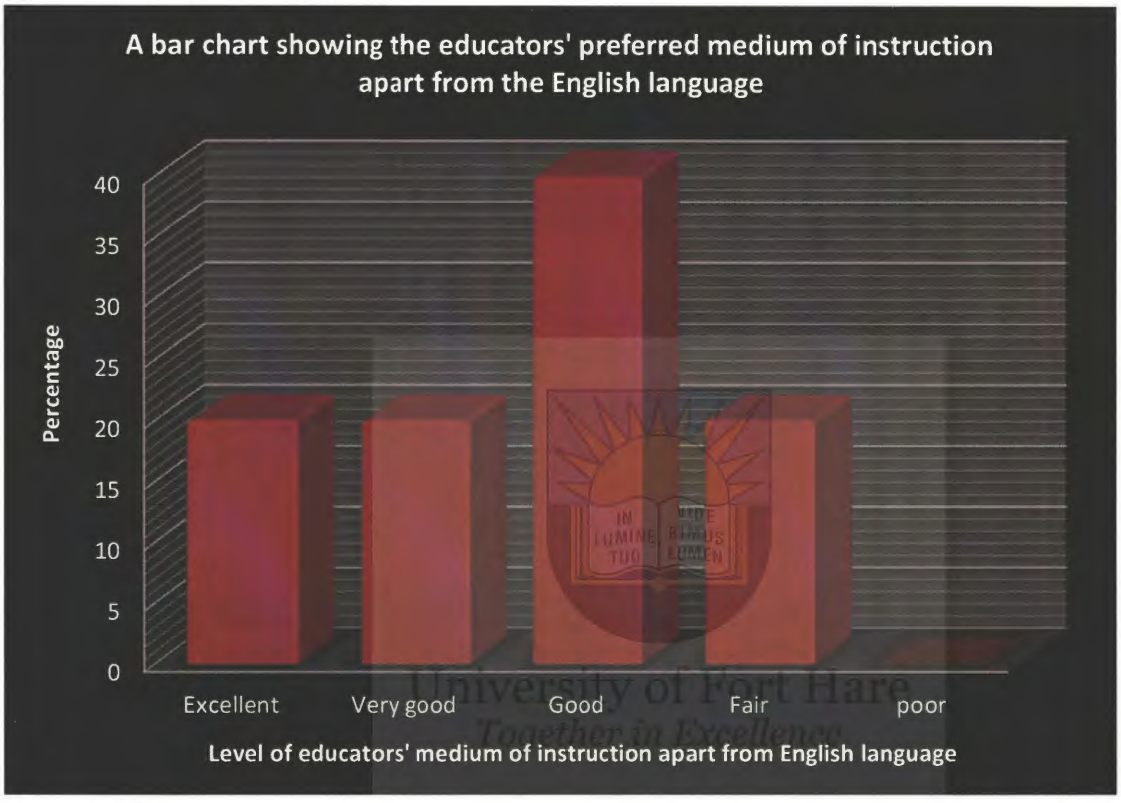
The aim of this question was to determine how educators evaluate themselves if their preferred medium of instruction is different from the one used in the school.

Table 4:30: *The level of expression of educators if his/her preferred medium of instruction is different from the medium of instructions being used in the school.*

Evaluation	No. of educators	Percentage
Excellent	1	20
Very Good	1	20
Good	2	40
Fair	1	20
Poor	0	0
Total	5	100

Source: *Field study (August, 2016)*

Fig.31.



The educators' level of medium of instruction if a different medium of instruction is used apart from their preferred medium of instruction.

Source: *Field study (August, 2016)*

From Table 4.30 above it can be observed that two (2) educators representing 40% indicated that their level of medium of instruction in the school apart from their preferred medium of instruction is "good", one(1) one educator representing 20% indicated that her level of medium of instruction in teaching aside her preferred medium of instruction is "excellent", another educator representing 20% stated that his medium of instruction in teaching aside his preferred medium of instruction is "very good", and the other educator stated that, her level of medium of instruction besides her preferred medium of instruction is "fair".

From the analysis above, it is clear the educators are comfortable with other forms of medium of instruction used in schools apart from their preferred medium of

instruction, except one educator who is not very comfortable with other mediums of instruction except the English language. The medium of instruction in most rural schools in South Africa is the home language; however, the learning materials are in the First Additional Languages which are English and Afrikaans. Learners are therefore faced with challenges understanding the concepts of mathematics in this regard (Education White Paper 6, pg.19).

4.5.15: Which of the following assessment tools do you adopt?

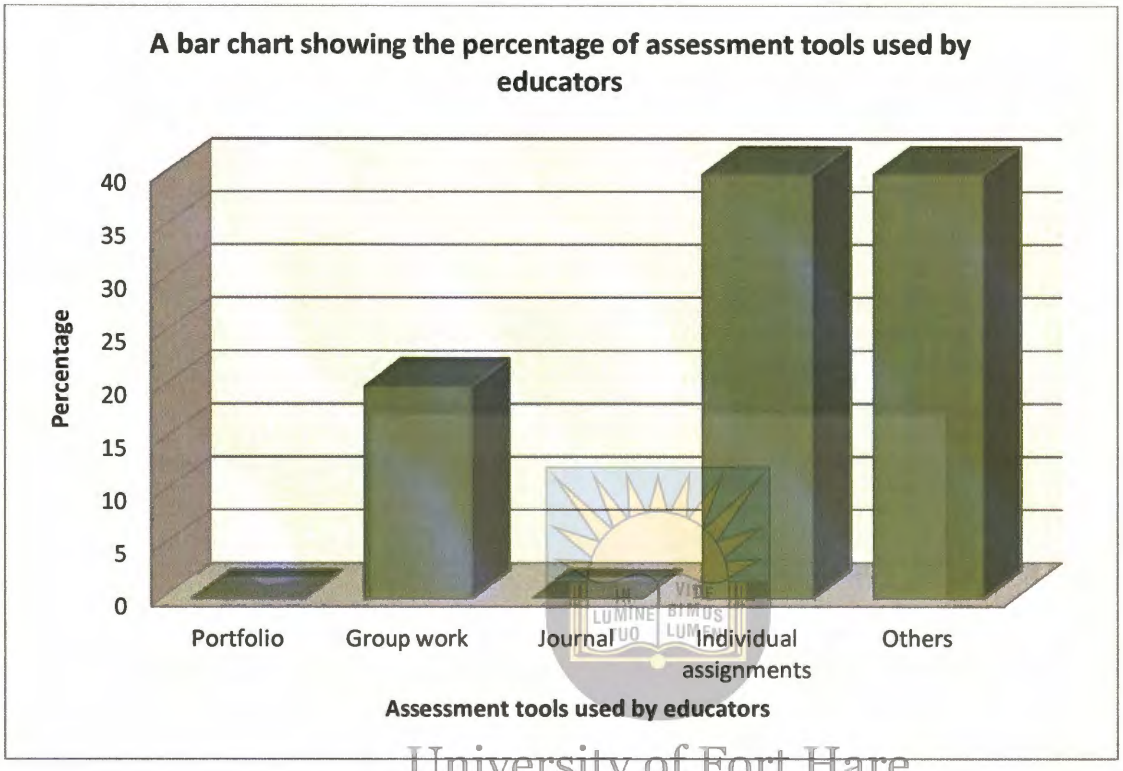
This question was to determine the assessment tools educators use to assess their learners.

Table 4:31: *The assessment tools used by the educators*

Assessment tool	No. of educators	Percentage
Portfolio	0	0
Group work	1	20
Journal	0	0
Individual assignments	2	40
Others	2	40
Total	5	100

Source: *Field study (August, 2016)*

Fig. 32.



The percentage of assessment tools used by educators.

Source: *Field study (August, 2016)*

From Table 4:31 above, it can be observed that two (2) educators representing 40% use individual assignments to assess their learners, two (2) educators representing 40% use other forms of assessment in assessing their learners, while one (1) educator representing 20% uses group work in assessing learners.

It can be deduce from the above analysis that educators use different forms of assessments such as test, projects, group work etc. to assess learners' performance in mathematics. If teachers provide clear evaluation criteria and individualised corrective feedback on tasks, the students' academic performance improves (Morais, 2002). Ramnarain (2013) found that summative examination systems facilitated extrinsic motivation in students and facilitated surface learning, as opposed to the deep learning required for studying mathematics and science.

4.5.16 Do you teach mathematics with the aim of getting all learners to pass their examination.

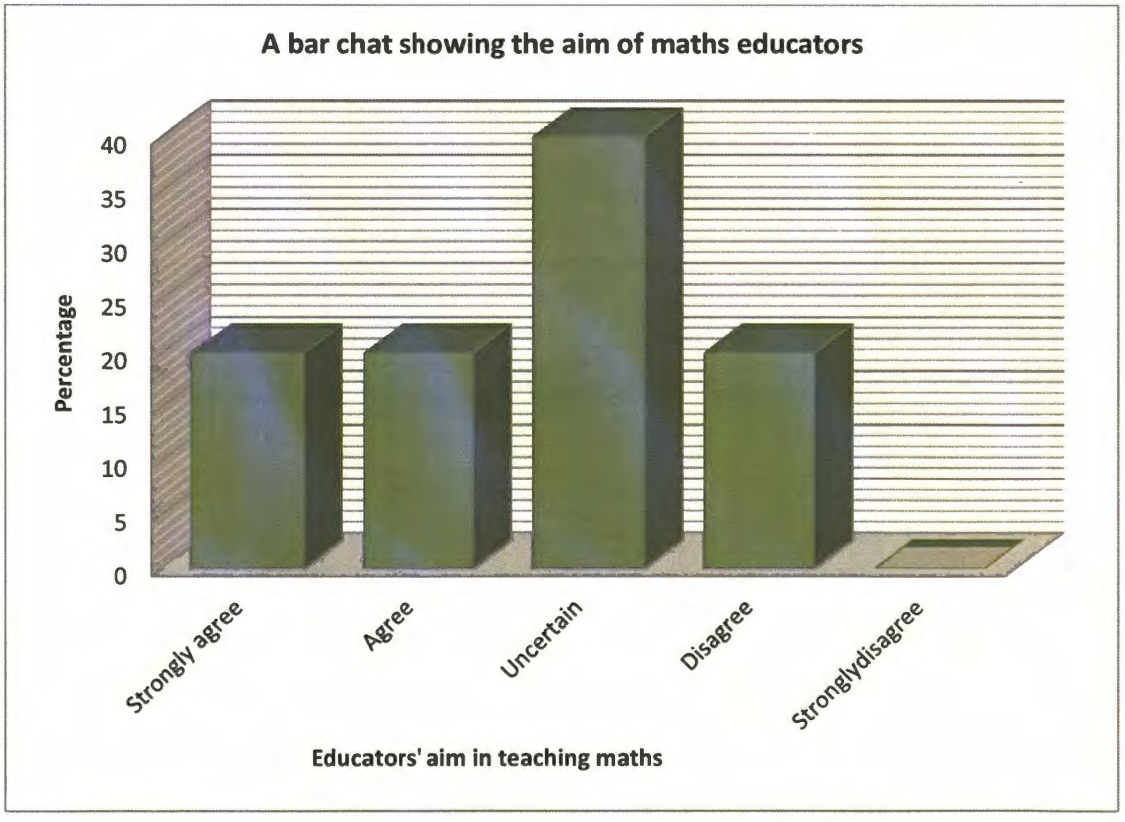
The purpose of this question was to find out the aim mathematics educators have in teaching grade 9 mathematics.

Table 4:32: *The response of mathematics educators teaching grade 9 mathematics with the aim of getting all the learners to pass their examination or not.*

Evaluation	No. of learners	Percentage
Strongly agree	1	20
Agree	1	20
Uncertain	2	40
Disagree	1	20
Strongly Disagree	0	0
Total	5	100

Source: *Field study (August, 2016)*

Fig. 33.



The aim of educators teaching mathematics in getting all the learners to pass their examination.

Source: *Field study (August, 2016)*

Table 4:32 above shows that two (2) educators representing 40% "uncertain" with the questionnaire that they teach mathematics with the aim of getting all learners to pass their examinations.

One (1) educator representing 20% "strongly agrees" with the question that they teach mathematics with the aim of getting all learners to pass their examination, one (1) educator translated to 20% "agrees" with the question while another educator representing 20% "disagrees" with the question that he/she teaches maths with the aim of getting all learners to pass their examination.

From the analysis above it can be observed that all the educators teach maths with the aim of getting all the learners to pass their exams, except one educator who is not sure he/she teaches mathematics with the aim of getting all learners to pass their examination. This might be due to the fact that the educator is not competent enough to teach the subject to guarantee that all the learners will pass in the subject.

On the other hand, the reason could be that the educator is not teaching only for examination purposes. The challenges of mathematics learning for today's education are that it requires disciplined study, concentration and motivation. To meet these challenges, learners must be focused and motivated to progress. Broussard and Garrison (2004) examined the relationship between classroom motivation and academic achievement in elementary school aged children. Consistent with previous studies, they found that for a higher level of mastery, motivation was related to higher mathematics grade.

4.5.17 I teach the learners so that they understand mathematical concepts and then use the knowledge for life

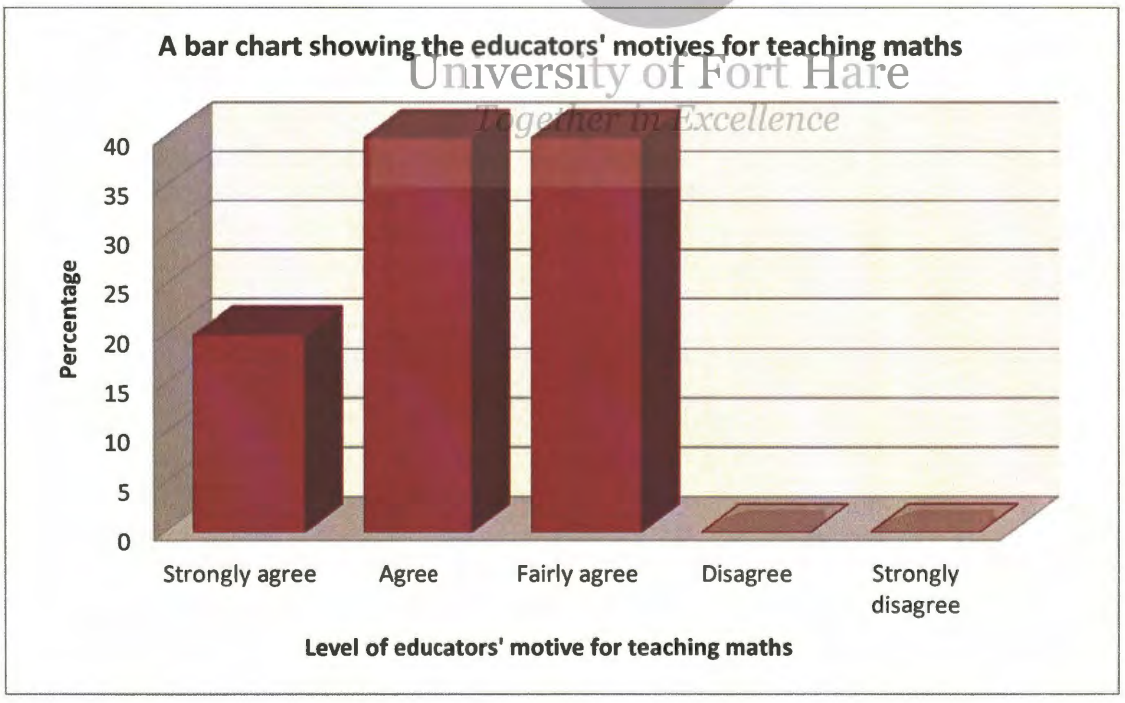
This question was to find out the extent to which educators agreed with the above motive for teaching mathematics.

Table 4:33: *The motive of educators teaching mathematics in grade 9.*

Evaluation	No. of learners	Percentage
Strongly agree	1	20
Agree	2	40
Fairly Agree	2	40
Disagree	0	0
Strongly Disagree	0	0
Total	5	100

Source: *Field study (August, 2016*

Fig.34.



Educators' motives for teaching mathematics in grade 9.

Source: *Field study (August, 2016)*

Table 4:33 above indicators that two (2) educators representing 40% "agree" with the question above, one (1) educator translating to 20% "strongly agrees" with the

question, another educator representing 20% "fairly agrees" with the question while another educator representing 20% "disagrees" with the question.

From the above analysis it is clear that majority of the educators teach learners so that they understand mathematical concepts and then use the knowledge for life. (Macleod & Golby, 2003) explain that, educators use the technique of encouraging learners to structure, provide meaning to experiences gained and allow the individual to "go beyond the information given".

4.5.18. I teach with the Revised National Curriculum Statement (RNCS) for mathematics given by the Department of Education.

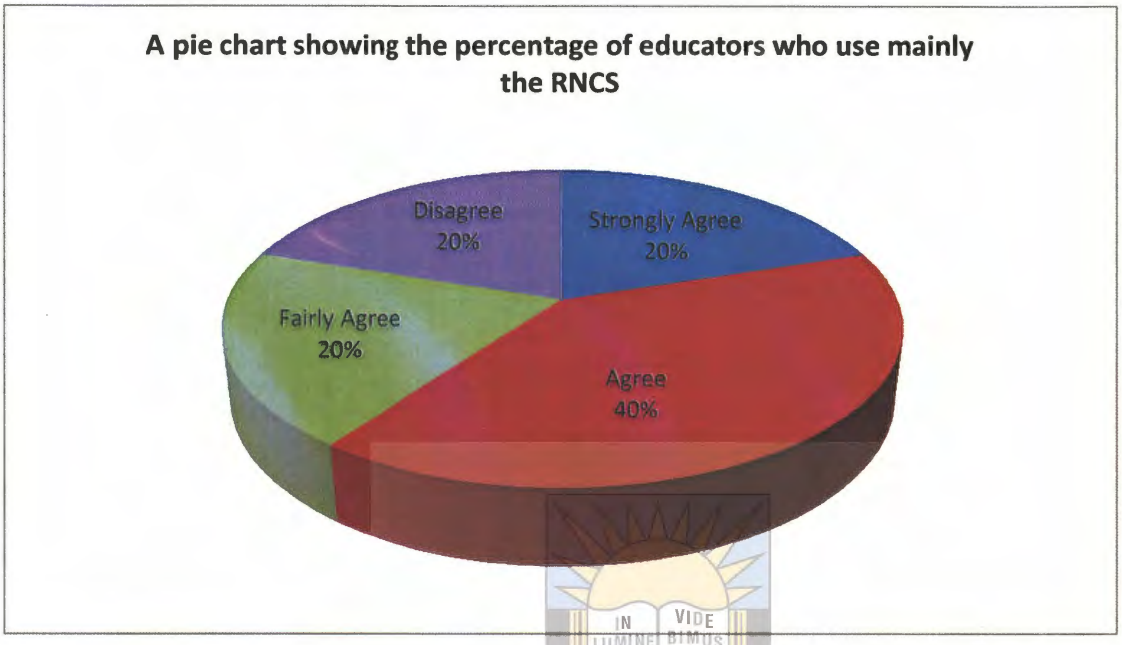
This question seeks to find out if educators base their teaching mainly on the Revised National Curriculum Statement (RNCS).

Table 4.34: *Educators who base their teaching mainly on the Revised National Curriculum Statement (RNCS) for mathematics given by the Department of Education.*

Evaluation	No. of educators	Percentages
Strongly agree	**1**	**20**
Agree	**2**	**40**
Fairly agree	**1**	**20**
Disagree	**1**	**20**
Strongly disagree	**0**	**0**
Total	**5**	**100**

Source: *Field study (August, 2016)*

Fig.35.



The percentage of educators who use mainly the (RNCS).

Source: *Field study (August, 2016)*

Table 4.34 indicates that two (2) educators representing 40% "agree" with the question, one (1) educator translated to 20% "strongly agrees" with the question that they use mainly the Revised National Curriculum Statement (RNCS) for teaching, another educator representing 20% "fairly agrees" with the questionnaire while one other educator representing 20% "disagrees" with the question.

From the above, it shows clearly that all the educators teach using mainly the Revised National Curriculum Statements (RNCS) with the exception of one educator who seems not to teach according to it . This could be due to the fact that the educator is not conversant with the RNCS. This attests to the fact that the Department of Education (DoE, 2011a) provided The National Curriculum and Assessment Policy Statement as a guideline that is intended to provide teachers, principals, subject advisors, administrators and other personnel with parameters and strategies on how to respond to learner diversity in the classroom through the curriculum.

In 2014, the final stage of the incremental implementation of the CAPS was also completed in the Senior Phase in grades 7, 8 and 9. CAPS, therefore, provided stability in the sector by giving teachers clear guidelines on content, pedagogy and assessment and this has positively influenced learner performance in these phases (CAPS, 2009).

4.5.19. I prefer context based teaching compared to content based teaching

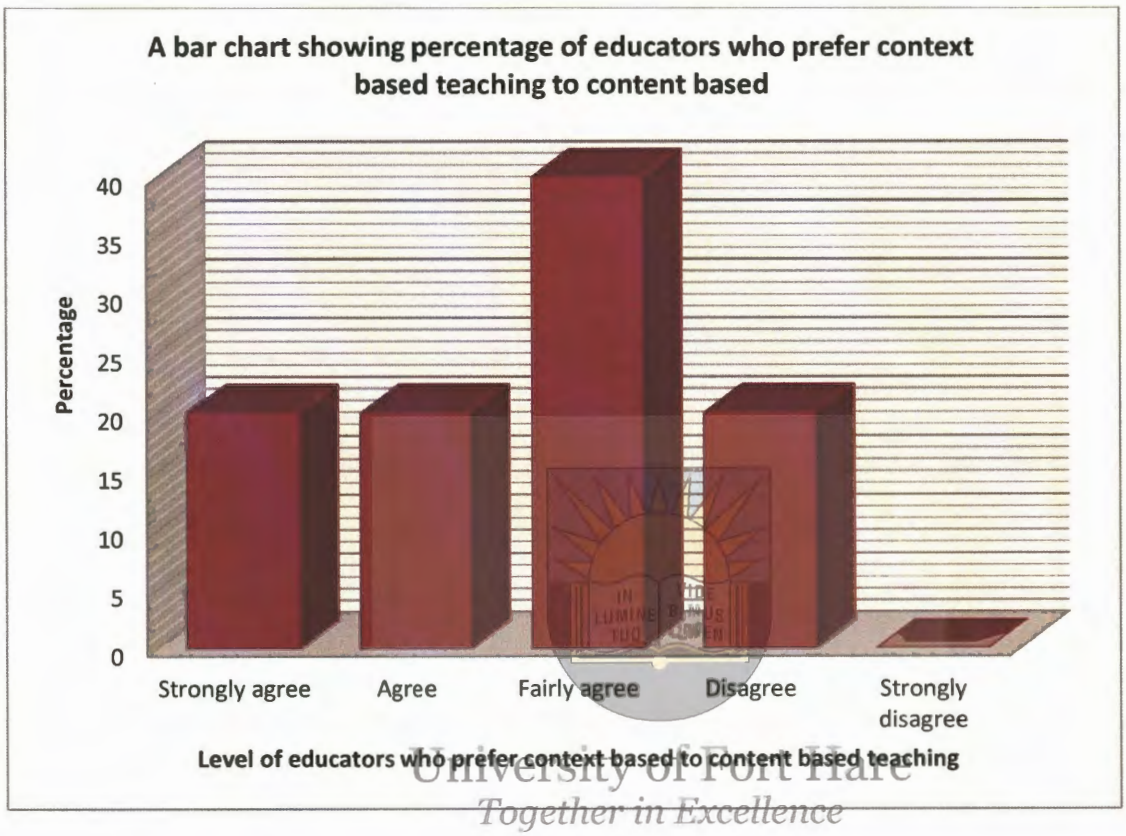
The purpose of this question was to find out whether educators prefer context based teaching or content based teaching.

Table 4.35: *The responses of educators who prefer context based teaching to content based teaching*

Evaluation	No. of educators	Percentages
Strongly agree	1	20
Agree	1	20
Fairly agreed	2	40
Disagree	1	20
Strong disagree	0	0
Total	5	100

Source: *Field study (August, 2016*

Fig.36.



The percentage of educators who prefer context based teaching to content based teaching.

Source: *Field study (August, 2016)*

Table 4.35 shows that two (2) educators representing 40% "fairly agree" that they prefer context based teaching to content based teaching, one (1) educator translating to 20% "strongly agrees" with the question above, another educator representing 20% "agrees" with the question above that he/she prefers context based teaching to content based teaching, and one other educator representing 20% "disagrees" with the question above.

According to Kumaradivelu (2001), context-based is a teaching method where the teacher generates theory of practice. It is a teaching approach method that encourages teachers to have the confidence to creatively reflect on their teaching practice as it responds to the particularities of their own teaching contexts. Byrnes (2000), explains content-based teaching as an instruction that provides for cognitive

engagement, tasks that are intrinsically interesting and cognitively engaging will lead to more and better opportunities for second language acquisition, this is particularly important when one considers the inherent complexity of adult learning.

From the analysis above it can be deduced that the majority of educators prefer context based teaching to content based teaching. However, one educator prefers content based teaching to context based teaching.

This might be due to the fact that some teachers are still having difficulties in implementing the Revised National Curriculum Statement (RNCS). The information gathered from the educators is essential to the study in the sense that an educator's teaching strategy is an important factor with regard to the performance of learners in mathematics .

The above analysis shows that teaching mathematics can be very challenging in the sense that each learner brings a unique mathematics challenges to class and it is the duty of the mathematics educator to identify the challenges of learners and develop a mathematical teaching strategy to help the learner overcome those challenges. Diversity through the national curriculum and the Assessment Policy Statement (DoE, 20lla) is a set of guidelines that is intended to respond to learner diversity in the classroom through the curriculum.

According to the guidelines for inclusive teaching and learning (2010) and the (DoE, 20106:19) lesson plans have to provide differential learning and assessment activities to ensure multilevel teaching. Therefore, it is imperative for the mathematics educators to help different learners in the mathematics classroom.

On the question of what are the major factors affecting grade 9 learners' performance in mathematics, the educators identified the following factors affecting grade 9 mathematics performance .

- Lack of basic numeracy and literacy skills
- Low motivation by government, the Department of Education and principals of the schools
- Language barrier
- Lack of parental responsibilities
- Poor infrastructure

On the assessment methods used in assessing learners, the educators stated the following:

- Tests
- Projects
- Learners' portfolios
- Journals
- Group work
- Individual assignments

4.6. SEMI-STRUCTURED INTERVIEW

The semi-structured interview was conducted to ten (10) respondents selected randomly from the population in an oral form and then analysed. The questions asked and the responses are as follows:

Question: What is your attitude towards mathematics?

Responses: Seven (7) respondents representing 70% responded that their attitude towards mathematics is negative while three (3) respondents representing 30% responded that they have a positive attitude towards mathematics. From the above response, it can be observed that the majority of learners have a negative attitude towards mathematics. This further affirms the responses of learners regarding their attitude towards mathematics as reflected in the structured questionnaire administered by the researcher.

According to Schereiber (2000), those who have positive attitudes toward mathematics have a better performance in the subject. However, according to Schenck (2011), learners' forgetfulness is an everyday occurrence in mathematics lessons. The reason for this forgetfulness is that interference inhibits learners from absorbing the information by rehearsing it mentally and establishing it in their working memories (Salvin, 2009). The researcher observed that most learners forget what is been taught because they do not pay attention in class. Some of the learners do not revise their notes at home. The classroom environment is not conducive for grasping information and most of the educators make the subject very boring for the learners.

Question: What do you find difficult in mathematics lesson?

Responses: Four (4) learners representing 40% responded that they lack understanding during mathematics lessons because it is full of abstractness and symbols.

Four (4) learners representing 40% responded that "they lack concentration during mathematics lessons because it looks boring to them". Two (2) respondents representing 20% also responded that "they do not follow what their mathematics educator teaches because their mathematics educator uses English language throughout the lesson". According to the review in Szucs & Goswami (2013), dyscalculia paradigm is a selective weakness of mathematics and about 6% of children and adults are affected by it. Baroody & Coslick (2008) indicate that learners with reading difficulties also find it difficult to read numerals, for example confusing 6 and 9, and reversing numerals and writing a 7 back to front.

This further attests to the fact that learners' understanding in mathematics is poor when the English language is used as a medium of instruction. Serame (2013) observed that learners' lack of concentration and boredom are the most prevalent misbehaviours in classrooms in South African rural schools, causing great concern to teachers.

Question: Who assists you in learning mathematics at home?

Response: Two (2) respondents representing 20% responded that their mothers help them in learning mathematics at home. Two (2) respondents translated to 20% responded that their siblings help them in learning mathematics at home and six (6) respondents representing 60% responded that they do not have anybody to help them with mathematics at home.

The majority of them said that "when homework is given, they do not do it because there is nobody to help them at home" (learner's own words). Some return to school the following day to ask their colleagues or teachers. This is a clear indication that most parents do not have formal education to assist their children at home or are not concerned about their children's mathematics progress. Quimbo (2003) attests to the fact that the influence of the parents in the meta-cognitive

trainings like study habits and achievement pressure can be considered as elements behind school performance.

Students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education (Campbell, Hombo, & Mazzeo, 2000).

Question: Do you use your teacher's method in solving mathematics problems?

Response: Two (2) learners presenting 20% responded "YES" and eight (8) learners representing 80% responded "NO" because they do not understand the educator's method. They said that "they get stuck when using their educator's method. Others said that, "it involves a lot of steps and it is so complex to them" (Learner's own words).

Maher and Davis in Ward (2001:2) emphasise that educators must be able to understand learners' constructions that differ from their own. They recounted the story of two learners and their educator who interpreted a problem differently. The problem involved two pizzas, each of which was sliced into twelve pieces. Maher and Davis in Ward (2001) emphasised when given the same problem the next year, the boys used the knowledge that they had constructed and arrived at the original answer. Educators therefore need to realize that solutions are built from past constructions and therefore will probably differ from their own. They must be willing to accept this diversity as long as it is mathematically valid (Ward, 2001:2).

Question: Do you like doing mathematics on your own? If not, why?

Response: Out of the ten (10) respondents, only two learners representing 20% responded that they study mathematics on their own. The majority of the learners said "they do not study maths on their own; this is because mathematics is difficult and they do not have interest in it" (learner's own words).

This attests to the fact that the majority of learners have a bad attitude towards mathematics. Ashcraft (2002) observes that mathematics anxiety interferes with mathematics performance. Ashcraft suggests that highly anxious mathematics students will avoid situations in which they have to perform mathematical calculations. However, mathematics avoidance results in less competency, exposure

and mathematics practice leaving students more anxious and mathematically unprepared to achieve (Ashcraft, 2002).

Question: Which medium of communication (language) do you prefer mathematics to be taught at school? Why?

Response: Two (2) respondents representing 20% responded mathematics should be taught in English because it is a universal language. Three (3) respondents representing 30% said mathematics should be taught in Afrikaans because it is their home language and they understand it better. Five (5) learners representing 50%, responded mathematics should be taught in Xhosa because it is their mother tongue and they understand mathematics terms and calculations very well when Xhosa is used (learner's own words).

The analysis above indicates clearly that the majority of the respondents want mathematics to be taught in their various languages instead of the English language.

Attitude to study: The researcher observed during a class session, that the majority of the learners had a negative attitude to their studies, especially to mathematics. Most of them talk unnecessarily when teaching is going on, some put their heads on the desk to sleep, and some do not write anything during teaching and learning. Classroom control was very difficult in some of the schools. Some teachers seems not to bother about what the learners do in class and this eventually affects the performance of learners in mathematics.

Classroom learning environment and classroom assessment were among the eight teachers' variables included in the dynamic model for measuring quality of teaching (Creemers & Kyriakides, 2008). Rajoo (2013) has shown that the quality of classroom learning environment is a significant determinant of students' mathematics achievement.

Question: Which mathematics topics do you like most and which ones do you dislike?

Response: The majority of the learners responded that they like mathematics topics like algebra, addition and subtraction, factorization, geometry, linear equations and simultaneous equations. They dislike mathematics topics like fractions and word problems. This is because they pose a lot of problems to them.

The following facts could be deduced from the above results:

- Learners have a bad attitude towards mathematics.
- Learners lack concentration and understanding during mathematics lessons.
- Learners do not get support from parents to study at home or do homework.
- Learners do not use their educator's method in solving mathematical problems because they do not understand the method.
- Learners prefer mathematics to be taught in their various home languages.
- Learners do not study mathematics on their own because they claimed they pose difficult questions.
- Learners do not like mathematics [illegible] fractions and word problems because they claim it poses a great challenge to them.

It is obvious that learners' attitude towards mathematics is very negative. It is therefore imperative for the mathematics educator to design an innovative and effective method of teaching mathematics.

4.7. FINDINGS FROM RESEARCHER'S OBSERVATIONS

The researcher's observations were based on time management, classroom environment and outside the classroom as well as the physical appearance and learners' attitude to study.

4.7.1 Time management

In terms of time management, the researcher observed that the majority of the educators and learners arrived at school late in the morning as at the time of the survey. This was because the majority of the educators and learners stay far away from the school. Educators and learners travelled long distances to school every day. This leads to classes in some of the schools starting at 9:00am instead of 8:20am.

This is one major contributory factor to the learners' poor performance in mathematics because time is wasted and also there is no form of interactions between learners and educators after school since they stay far from each other. (Magher, 2005) shows that students are much more motivated if they can solve the task in a personal rhythm. Students should be aware of the hours of maximum effort and should adapt their personal rhythm to circadian and ultradian rhythm.

4.7.2 Classroom environment

In most of the schools visited, the researcher observed that there were overcrowded classrooms. Most of the classrooms had over 40 learners. Considering the fact that the recommended educator-learner ratio for high schools is 1:35, this condition seriously impedes the educators' ability to move round the classroom to offer assistance to learners.

Learners sit very close to each other. This can seriously lead to learners copying from each other during examinations and classwork. The researcher observed that most of the classrooms had broken windows, falling ceiling and no lighting system. This could seriously affect teaching and learning of mathematics during bad weather conditions such as winter and summer. Learners are found standing outside under the sun when the classrooms are cold. This eventually contributes to factors affecting learners' performance in mathematics. Researchers also found a negative impact on student achievement where deficiencies of school features or components such as temperature, lighting, and broken furniture exist. Harner (1974) attests to the fact that temperature above 23° C (74° F) adversely affects mathematics skills. In terms of the condition of school buildings, Cash (1993) found student achievement scores in standard buildings to be lower than the scores of students in above standard buildings. In addition, Rivera-Batiz and Marti (1995) conducted multiple regression statistical analysis to examine the relationship between overcrowded school buildings and student achievement. The findings indicated that a high population of students had a negative effect on student achievement.

4.7.3. Outside classroom environment

The researcher observed that most of the schools do not have good playing grounds for learners to exercise themselves during break time. This could lead to poor

performance of learners because it is said that "all learning and no play makes Jack a dull boy". Learners need to exercise themselves to refresh their minds and bodies. Where there is youth violence in schools the fear factor prevents learners from regular attendance. Also, research has found that there have been reported cases of violence at some schools in South Africa and this makes learners feel unsafe and absent themselves from school (DoE, 2002).

4.7.4 Attitudes towards study

The researcher noticed that the majority of the learners had a negative attitude towards their studies, especially mathematics. Most of them talk unnecessarily when teaching is in progress. Some put their heads on the desk to sleep, others do not write anything during lesson. Classroom control was very difficult in some of the schools. Some teachers seems not to bother about what the learners do in class and this eventually affects the performance of learners in maths. Teachers who are themselves anxious about their mathematical abilities often dampen the zeal learners have for the subject (Gatto, 2013). According to Schereiber (2000), those who have positive attitudes toward mathematics have a better performance in the subject.

4.8. CONCLUSION

This highlights the findings from the learners, educators and researcher observations about factors affecting grade 9 learners' performance. This was summarized and analysed. In the final chapter, a conclusion is provided that summarizes the research, describes the main research finding and offers recommendations for further study.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This study examined the factors affecting grade 9 learners' performance in mathematics in the King William's Town education district. This chapter summarises the findings, draws conclusions based on the findings and also make recommendations to learners, educators, principals, the Department of Education, government, and stakeholders. The study made use of mixed methods' research using both qualitative and quantitative methods to examine the factors affecting grade 9 learners' performance.

Structured questionnaire, semi-structured interview and observations were used to elicit information for the study. The learners' questionnaire was structured into three sections which were: demographic details of learners, factors affecting learners' performance and recommendations. The educators' questionnaire also included demographic information of educators, factors affecting teaching and learning of mathematics in grade 9, and recommendations.

5.2 SUMMARY OF THE FINDINGS

The main findings of this study were based on the factors affecting grade 9 learners' performance in mathematics in the King William's Town education district. The following factors came to light as discussed in the previous chapter.

5.2.1 Lack of parental responsibilities

From the previous chapter, it was observed that the majority of the learners are living with their relatives, especially their grandparents. Most of this grandparents are old and do not have formal education to help learners with mathematics at home. It was shocking to learn that some of the learners are also living on their own at home due to the death of either parents or parents deserting home or lack of parental responsibilities. Such learners find it difficult to cope with mathematics lessons at school since they dodge classes to go and look for their daily bread. They are mostly

not regular at school and lack supervision at home. Dednam (2005:199) asserts that regular absence from school and change of schools are two of the most important causes of mathematical difficulties as they cause backlogs in mathematics knowledge. Wamala et al. (2013) attest to the fact that parents and the society can exert a positive influence on their children's mathematical performance. Parental responsibilities are therefore very necessary in the educational life of the learners.

5.2.2 Learners' and educators' attitude to mathematics

The study also revealed that learners have a very bad attitude towards mathematics. The majority of the learners do not study mathematics on their own unless they are forced to do so. The attitude of the educator also plays a very vital role in the teaching and learning of mathematics. Although the study shows that all the educators surveyed had studied mathematics at the university, some of them are not competent in teaching grade 9 mathematics as they lack basic mathematical concepts.

Goulding et al. (2002) stated that there are linkages between a teacher's lack of subject knowledge and the ability to plan teaching materials effectively. These findings suggest that teachers who do not have sufficient background knowledge in mathematics may struggle with the development of comprehensive lesson plans for their students and this eventually leads to the poor performance of learners in mathematics.

5.2.3 Classroom environment

It was observed from the study that most of the classrooms were overcrowded. Learners sit close to one another in the classrooms which enable them to copy from each other during tests or examinations, and they also misbehave when classes were going on. This situation does not allow the educator to move round to offer assistance to learners during mathematics lessons. It also makes class control very difficult for the educator. It is therefore obvious that overcrowded classrooms are not ideal classrooms for effective teaching and learning of mathematics. Also, most of the classrooms have broken windows and falling ceilings which affects teaching and learning during adverse weather conditions. (Rajoo, 2013) explained that the quality

of the classroom learning environment is a significant determinant of student's mathematics achievement.

5.2.4 The distance learners and educators travel to school

The study has revealed that both the learners and educators stay very far away from the school premises. Most of the schools are situated at places where learners and educators travel long distances to school every day and this affects the first lesson on the school's time table. Studies of the day begin late due to the late arrival of learners and educators at school. Educators are of the view that there is no decent accommodation in places where the schools are situated and the security nature of the place is also a source of worry to them. These concerns made it difficult for them to stay around the school premises. It also came to light that learners do not have access to their educators for assistance after school. The situation of long distance to school warrants learners to absent themselves from school regularly, especially when they do not have money for transport and also when there are bad weather conditions such as rainstorms or the winter season when the learners have to walk long distances to school. This eventually contributes to learner' dismal performance in mathematics.

5.2.5 Lack of motivation

Lack of motivation on the part of mathematics educators and learners adversely affects learners' performance in mathematics. Mathematics educators lack motivation from government and the schools in which they are teaching. They lack teaching and learning materials to enhance effective teaching and learning. Mathematics educators are still sticking to the orthodox method of teaching while mathematics has reached its scientific and technological age. No innovation or creativity is brought to the mathematics classroom to motivate the learners. Adu et al. (2014) assert that the use of ICT to support teaching and learning within mathematics remains under developed. Learners lack motivation to study mathematics because they see mathematics as a boring subject and also because it deals with lots of formulas. Some of the learners are of the view that mathematics is

a subject for the gifted and not for every learner. These are wrong impressions by the learners which do not motivate them to study the subject.

5.3 SUMMARY OF THE FINDINGS ON FACTORS AFFECTING LEARNERS' PERFORMANCE IN MATHEMATICS

Some of the factors affecting grade 9 learners' performance are identified as follows:

- Bad attitude of learners towards the subject mathematics. Learners do not study mathematics after school unless they are forced to do so.
- Mathematics anxiety among learners is also a cause of learners' poor performance in the subject.
- Some of the mathematics educators lack basic mathematical concepts to teach to the understanding of the learners.
- Lack of motivation from school principals, the Department of Education and government to enhance the teaching and learning of mathematics. Mathematics is taught without the appropriate teaching and learning materials.
- Language barrier on the part of learners is also a major factor affecting learners' performance. The majority of the learners experience difficulties in understanding mathematical concepts when the medium of instruction is English.
- Lack of support by parents cannot be over emphasised. The majority of the learners do not get the needed support from their parents to learn mathematics at home.
- Overcrowded classrooms, broken windows, falling ceilings and broken doors affect teaching and learning of mathematics especially during winter and raining seasons.
- Lack of interaction between educators and learners after school affects the performance in mathematics.

5.4 RECOMMENDATIONS

The following are some of the recommendations made by the researcher to the learners, educators, principals, the Department of Education, parents, government and other stakeholders:

5.4.1 Recommendation to the learners

- Learners must develop a positive attitude towards mathematics. By so doing they become motivated to learn the subject more. Learning mathematics is not an event but a process and therefore it must be studied every day. Learners should make a conscious effort to solving mathematical questions at least each and every day. Consistent practice will make them perfect and familiar with the trend of questions set in the examinations and how to solve them.
- Learners ought to form study groups among themselves. These study groups give opportunity to learners to explore and come out with the possible solution to mathematical problems. It also enables the good students in mathematics in the group to offer assistance to the weaker learners. Learners among themselves understand each other better and also they feel free to express their challenges and concerns.
- Learners who are weak in mathematics ought to spend more time on mathematics than the other subjects. This will enable them enough time to solve different types of mathematical problems. They must approach their educators and people who are good in mathematics to help them when faced with difficulties in the subject. Learners must also prepare in advance for mathematics tests or examinations in order to avoid mathematics anxiety.
- Learners must have enough rest to keep the body and the minds relaxed. Learners must eat well balanced meals to keep the body healthy always. A healthy body enhances the performance of mathematics.
- Learners must also read a lot of story books to improve their English language since mathematics revolves around the English language and it is also the medium of instructions in schools and in the setting of mathematical questions.

5.4.2 Recommendations to educators

- Educators should offer remedial teaching to learners. This will help cater for all types of learners with different learning difficulties in the mathematics class. One-on-one tuition should be offered by the mathematics educator to

enable learners who are shy to ask questions in class the opportunity to do so privately.

- Educators must attend in-service training and workshops in order to update their teaching methods in mathematics. They could also make efforts to educate themselves on new and technological trends in teaching methodologies by making use of modern literature. They must also employ the services of the subject advisers to help them out on topics that seem challenging to them.
- Educators should use a learner-centred approach in teaching mathematics. This could include a discussion method, brainstorming method, research method, etc. This approach creates an environment for learners to express themselves freely and also work independently without necessarily depending on the mathematics educator for answers.
- The mathematics educator should have a sense of humour. He/she must be warm and welcoming to enable lea[illegible]proach him/her when faced with difficulties in mathematics and he/she must be ready to assist learners with mathematical problems.

5.4.3 Recommendation to principals

- Principals should create a conducive environment for both the educators and learners to enhance teaching and learning of mathematics.
- Principals should reward hardworking educators and learners especially in mathematics and also reprimand educators and learners who do not attend classes or absent themselves from school. The rules and regulations governing the teaching profession should be applied when necessary to deter recalcitrant educators and learners.

5.4.4. Recommendations to the Department of Education

- The Department of Education should conduct extensive teacher training with the integration of Information Communication Technology (ICT) teaching providing detailed lesson plans and study guides and providing learners and educators with previous examination question papers of the Annual National Assessment (ANA) and National Senior Certificate (NSC).

- The department of education should ensure that all the schools have proper classrooms with heaters and air conditioning to regulate the temperature of the classrooms during the winter and summer seasons.
- Instances where educators are promoted to fill positions which are not related to their subject discipline should stop. There are cases where educators who have majored in social sciences are promoted as the Head Of Department (HOD) for the mathematics and science departments. This practice dampens the morale of the mathematics educator hence leading to the poor performance of mathematics in the school.
- The Department of Education should organize workshops and seminars for mathematics educators regularly on the new trends and innovative methods of teaching mathematics. Workshops should also be conducted to train principals and members of the School Management Teams (SMT) on leadership and curriculum management, and also conduct extra tuition for learners on weekends and holidays.
- The Department should ensure that educators who perform well in producing good results in mathematics should be maintained in the classrooms and not be sent to the education office. Such educators can be promoted to the ranks of Head Of Department (HOD) of mathematics or principal and still be in the school teaching and producing the best results in mathematics.

5.4.5 Recommendation to parents

- Parents must be actively involved in their children's education by providing them with all the basic needs to enhance the learning of mathematics. Parents must attend school meetings in order to give inputs that will benefit their children and the school.
- Parents ought to assist and supervise their children in doing their homework. Their mere presence and concern serves as a motivation to the learner in learning mathematics.
- Parents should provide a conducive home environment for their children to learn. This conducive environment should be devoid of quarrels and fighting among parents. The incident of broken home and irresponsibility on the part of the parents must cease.

5.4.6 Recommendation to government

- Aside the establishment of the universities, the government must also establish teacher training colleges to train teachers with the basic mathematical skills for primary schools. This will help lay a strong foundation in mathematics at the basic level before learners enter high schools. This will go a long way in building a strong mathematical environment at the basic schools which will then be extended to the high schools. This establishment of teacher training colleges will eliminate the tendency of people taking up teaching jobs without having the basic requirements.
- Boarding systems in all the high schools should be introduced. This is a system where learners and educators are accommodated on the school premises. This will enable learners to have access to educators at any time of the day. Educators will also have enough time to have teaching contact with the learners. Preparatory classes and other co-curriculum activities will be effectively monitored by the educators in the boarding system. The refreshing part of the boarding system is that truancy and absenteeism on the part of the learners and educators are effectively checked.
- The government can also set aside a fund to motivate learners and educators teaching mathematics. This could be done by rewarding learners and educators who do well in mathematics at the end of the term. This will motivate learners and educators to give their best. Educators teaching in rural schools ought to be motivated by providing them with decent accommodation and a rural allowance.

5.4.7 Recommendation to stakeholders

- Since education is the key to the development of every nation, it will be very prudent for all stakeholders such as private companies and organisations to channel their resources to the development of mathematics in our schools. By so doing the schools will be able to produce qualified personnel such as the accountants, engineers and doctors needed to manage the state institutions.
- Stakeholders should also establish a mathematics resource centre in every district to enable learners and educators to have access to the modern and scientific methods of teaching and learning mathematics.

5.5 LIMITATIONS OF THE STUDY

The study was limited to only some selected schools in King William's Town education district in the Eastern Cape province of South Africa. In effect, the results from the study will not be conclusive as to what pertains in all the schools in South Africa.

There was a communication barrier between the respondents and the researcher since the researcher cannot speak isiXhosa. The researcher therefore employed the services of one of the educators to translate some of the items in the questionnaire which altered the meaning of what the researcher was asking for.

The researcher could not visit the homes of the respondents to ascertain the situations prevailing in the various homes of the learners and this may have affected the validity of the study.

Since notes were taken by the researcher as well as interviewing the learners, the researcher could not capture everything that was said and this may have affected the validity of the study.

The proximity of the schools and where the researcher is living could not permit the researcher to reach some of the schools soon enough to check on the arrival of the educators and the learners.

5.6. CONCLUSION

In examining the factors affecting grade 9 learners' performance in mathematics in the King William's Town education district, it is prudent for all stakeholders, government and the Department of Education to find a lasting solutions to these factors affecting learners' performance in mathematics since mathematics forms the core factor for the development of every nation. These learners are the future leaders of South Africa and must be helped to overcome all factors affecting their mathematics performance.

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APPENDIX A

INTRODUCTORY LETTER FROM MY SUPERVISOR

University of Fort Hare
Together in Excellence

University of Fort Hare
Faculty of Education
School of General & Continuing Education(SGCE)
East London Campus:
Private Bag X9083, 50 Church Street, East London, 5200, RSA
Tel: +27 (0) 43 704 7221 • +27 (0) 43 704 7216 • Fax: +27 (0) 86 628 2153
Email: nsiboko@ufh.ac.za • aboysen@ufh.ac.za

University of Fort Hare
Together in Excellence

01 June 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: Mr. George Adom (201509244)

This document serves to confirm that:

(a) the above student is registered for MEd at this university;

(b) The research proposal for his master dissertation was approved by the Faculty Research & Higher Degrees Committee.

In order for him to administer his questionnaire, he needs your express permission as a school. Please grant him the necessary assistance.

May I also request your cooperation am[illegible]tudent.

Thank you

Professor E.O. Adu PhD
Email: eadu@ufh.ac.za
Cell: 084 925 1948

UNIVERSITY OF FORT HARE
EDUCATION FACULTY OFFICE
Cnr. Fleet / Cambridge Streets
Private Bag X9083, East London 5200
TEL: 043 704 7227 / 7218 / 7177
Signature : .....
Date : 11-07-2016

APPENDIX B

INTRODUCTORY LETTER FROM THE DEPARTMENT OF EDUCATION – KING WILLIAM'S TOWN DISTRICT

Province of the
EASTERN CAPE
EDUCATION

OFFICE OF THE DISTRICT DIRECTOR
45 Eales Street, King William's Town, 5600, Private Bag X74445, KWT, 5600
REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

Tel: 043 6050 106

Email: lelethu.magele@edu.ecprov.gov.za

Mr G. ADOM

TO WHOM IT MAY CONCERN

Dear Sir/ Madam

1. This is to confirm that **Mr G. Adom** is undergoing his MEd with the **University of Fort Hare.** He needs to do the research in the following schools:- **KUYASA HIGH SCHOOL, BISHO HIGH SCHOOL, NOSIZWE SCHOOL, DE VoS MALAN HIGH SCHOOL and ENOCH SONTONGA HIGH SCHOOL.** The topic of this project is **"FACTORS AFFECTING GRADE NINE LEARNERS PERFORMANCE IN MATHEMATICS IN KING WILLIAM'S TOWN EDUCATION DISTRICT".**
2. Kindly assist and co-operate with him in ensuring that this research is done and completed.
3. Thanking you in advance for your co-operation.

Yours faithfully

E. KATSHAZA
(A)DISTRICT DIRECTOR
KWT EDUCATION DISTRICT

APPENDIX C

LEARNERS' QUESTIONNAIRE

University of Fort Hare
Together in Excellence

QUESTIONNAIRE FOR GRADE 9 MATHEMATICS LEARNERS IN SELECTED SCHOOLS IN KING WILLIAM'S TOWN

Section A

1. Indicate your age in years

Below 12	13 – 15	16 - 18	19+

2. Gender or Sex

Male	Female

3. Indicate your Town/Location

4. Race or Racial Group

African	Coloured	Indian	Asian	White

5. Whom do you live with?

Both parents	Father only	Mother only	Guardian	On my own

6. The highest educational level of parent/guardian

Never been to school	Up to primary level	Up to high school	Completed Matric	Up to tertiary level	Post graduate level

7. Employment status of parents

Unemployed	Employed	Unknown

8. What is your mode of transportation to school?

By walking	Bicycle	Public transport .

Section B

9. What is your attitude towards the subject mathematics?

Excellent	Very good	Good	Fair	Poor

10. What is your level of understanding when English is used as a medium of instruction in teaching mathematics?

Excellent	Very good	Good	Fair	Poor

11. What is your level of confidence in answering mathematics questions?

Very High	High	Low	Very low

12. How do you evaluate the methods your mathematics educator uses in teaching?

Excellent	Very good	Good	Fair	Poor

13. What is the level of motivation given you by your mathematics educator in studying mathematics?

Very High	High	Low	Very Low

15. How do you evaluate the examples and activities in the grade 9 mathematics textbooks?

Excellent	Very good	Good	Fair	Poor

16. What is the state of your study of mathematics at home after school?

Excellent	Very good	Good	Fair	Poor

17. How do you rate your parents'/guardians' assistance or supervision of mathematics at home?

Excellent	Very good	Good	Fair	Poor

Section C

18. How do you want mathematics to be handled in order to improve your performance?

.....

.....

.....

.....

.....***Thank you very much.***

APPENDIX D

EDUCATORS' QUESTIONNAIRE

University of Fort Hare
Together in Excellence

QUESTIONNAIRE FOR GRADE 9 MATHEMATICS EDUCATORS IN SELECTED SCHOOLS IN KING WILLIAM'S TOWN

SECTION A

1. Indicate your age in years

Below 20 years	21 – 30 years	31 – 40 years	41+ years

2. Sex

Male	Female

3. Race or racial group

African	Coloured	Indian	Asian	White

4. Highest educational level

Matric level	Diploma	Honours	Post graduate

5. Indicate the major subjects studied

6. Number of years teaching grade 9 mathematics

Less than a year	2 – 5 years	6 – 9 years	10+ years

7. Number of in-service training attended in mathematics in a year

None	Once	Twice	More than thrice

8. How do you evaluate the in-service training you attended in mathematics?

Excellent	Very Good	Good	Fair	Poor

SECTION B

9. How do you evaluate yourself in the teaching of mathematics?

Excellent	Very Good	Good	Fair	Poor

10. How do you evaluate the teaching and learning materials for mathematics?

Excellent	Very Good	Good	Fair	Poor

11. How will you rate motivation of government to teachers teaching mathematics?

Excellent	Very Good	Good	Fair	Poor

12. How do you rate your encouragement to learners to use different methods in solving mathematical problems?

Excellent	Very Good	Good	Fair	Poor

13. What is your preferred medium of instruction used in teaching mathematics?

English	Afrikaans	Xhosa

Specify .....

14. If the medium (above) is different from the one being used in the school, how do you evaluate your medium of instruction?

Excellent	Very good	Good	Fair	Poor

15. Which of the following assessment tools do you adopt?

Portfolio	Group work	Journal	Individual assignments	Others

Specify.....

16. I teach mathematics with the aim of getting all learners to pass their examination.

Strongly agree	Agree	Fairly Agree	Disagree	Strongly disagree

17. I teach the learners so that they understand mathematical concepts and then use the knowledge for life.

Strongly agree	Agree	Fairly Agree	Disagree	Strongly disagree

18. I teach using mainly the Revised National Curriculum Statement (RNCS) for mathematics given by the Department of Education.

Strongly agree	Agree	Fairly Agree	Disagree	Strongly disagree

19. I prefer context based teaching compared to content based teaching

Strongly agree	Agree	Fairly Agree	Disagree	Strongly disagree

SECTION C

20. Your recommendation to government and the stakeholders

.....
.....
.....
.....
.....
.....

Thank you very much

APPENDIX E

SEMI – STRUCTURED QUESTIONNAIRE

University of Fort Hare
Together in Excellence

INTERVIEW QUESTIONS FOR GRADE 9 LEARNERS

1. What is your attitude towards mathematics?
2. What do you find difficult in the classroom when you are doing mathematics?
3. Who assists you in learning mathematics at home?
4. Do you use your teacher's method in solving mathematics problems? If no, why not?
5. Do you like doing mathematics on your own? If no, why not?
6. Which medium of communication do you prefer mathematics to be taught in at school? Why?
7. Which mathematics topics do you like most and which ones do you dislike? Why?

APPENDIX F

ETHICAL CLEARANCE CERTIFICATE

University of Fort Hare
Together in Excellence

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number: ADU101SADO01

Project title: **Examining factors affecting grade nine learners performance in mathematics in King Williams Town Education District.**

Nature of Project: Masters

Principal Researcher: George Adom

Supervisor: Prof E.O Adu
Co-supervisor: N/A

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

APPENDIX G

LANGUAGE EDITOR CERTIFICATE

University of Fort Hare
Together in Excellence

8 Nahoon Valley Place

Nahoon Valley

East London

5241

6 October 2016

TO WHOM IT MAY CONCERN

I hereby confirm that I have edited the following Master's thesis using the Windows "Tracking" system to reflect my comments and suggested corrections for the student to action:

An examination of factors affecting Grade 9 learners' performance in mathematics in the King William's Town District by George Adom, a thesis submitted in fulfilment of the requirements for the degree of Masters in Education at the University of Fort Hare

Brian Carlson (B.A., M.Ed.)
Professional Editor

Email: bcarlson521@gmail.com

Cell: 0834596647

Disclaimer: Although I have made comments and suggested corrections, the responsibility for the quality of the final document lies with the student in the first instance and not with myself as the editor.

BK & AJ Carlson Professional Editing Services