



UNIVERSITY OF  
KWAZULU-NATAL  
INYUVESI  
YAKWAZULU-NATALI

**Exploring Grade 9 mathematics learner performance in schools that  
participated in the 1+9 programme**

**By**

**Edward Sazi Ngcobo**

**200201775**

**Dissertation submitted in fulfilment of the requirements for the degree  
MASTER OF EDUCATION**

**With specialisation in**

**MATHEMATICS EDUCATION**

**UNIVERSITY OF KWAZULU-NATAL**

**Supervisor: Dr Zanele Ngcobo**

**Student: Edward Sazi Ngcobo**

**Signature: \_\_\_\_\_**

**Signature: \_\_\_\_\_**

**Date: 18/08/2021**

**Date: 12/08/2021**

## DECLARATION

I, Edward Sazi Ngcobo (**Student number: 200201775**), herewith declare that this thesis titled **Exploring Grade 9 mathematics learner performance in schools that participated in the 1+9 programme** is my work and that all the sources that I have used or quoted have been indicated and acknowledged using complete references.

I further declare that I have not previously submitted this work, or part of it, for examination at UKZN for another qualification or at any other higher education institution.

Signature



Date

12/08/2021

## ACKNOWLEDGEMENTS

This study is probably the best trial of my capacities as a scholar, and tried my determination to adjust to complete these studies as well as my responsibilities as a full-time teacher. This thesis would not have arrived at fulfilment if it were not for the individuals acknowledged here who were instrumental in its fruitful completion. My sincerest appreciation and thanks go to the accompanying, who all helped through this research venture:

- Firstly, to the Almighty – nothing would be conceivable without your perfect beauty. Much obliged to you for allowing me the mental fortitude, tolerance, strength and a never surrender disposition.
- To my supervisor, Dr Zanele Ndlovu, this thesis would not have occurred without your help, direction, counsel and pushing me to draw out the best from myself.
- To Leverne Gething, thank you for editing this work.
- To the staff of UKZN, thank you for continually being accessible to help with inquiries and making this excursion a charming one.
- Lastly, to the schools, learners and teachers that took an interest in this research, thank you for your understanding and time, and for making this study a success.

## **DEDICATION**

This study is dedicated to all my children – you are the best gifts that God has given me, you are my blessings, inspiration and reason to press on and never quit, even when the going gets tough.

## List of tables

	<b>Page</b>
Table 1.1: Average marks in mathematics (%) by grade for the Annual National Assessment (ANA), 2011–2014.....	24
Table 4.1 Coding of participants.....	79
Table 5.1 Mathematics Marks (%) for learners in 2016, 2017 and 2018-school A.....	84
Table 5.2 Mathematics Marks (%) for learners in 2016, 2017 and 2018-school B .....	86
Table 5.3 Mathematics Marks(%) for learners in 2016,2017 and 2018-school C.....	87
Table5.4 Mean Mathematics (%) for each school for the three years.....	90
Table 5.5 Inductive Analysis of teachers interview responses .....	102
Table5.6 Previous Professional development and knowledge of the 1+9 Programme.....	103
Table 5.7 Teachers opinions on the most important characteristics of effective mathematics Educators.....	104

## List of figures

	<b>Page</b>
Figure 1.1: Number of Grade 12 learners who enrolled for and wrote mathematics in the years 2016, 2017 and 2018, by province.....	18
Figure 1.2: Grade 12 learners who passed mathematics in each province in South Africa, 2016, 2017 and 2018.....	19
Figure 1.3 Grade 12 learners who wrote mathematics examination in 12 districts in KZN in 2016, 2017 and 2018.....	21
Figure 1.4 Average performance (%) of Grade 12 learner’s mathematics examination in 12 districts in 2016.....	22
Figure 1.5 Average performance(%) of Grade 12 learners mathematics examination in 12 districts in 2017.....	22
Figure 1.6 Average performance (%) of Grade 12 learner’s mathematics examination in 12 districts in 2018.....	23
Figure 1.7 Performance of learners (% scoring below 40%) in the ANA 2013 and 2014 in the nine Provinces.....	26
Figure 1.8 Performance of learners in the ANA 2013 and 2014 in each district in KZN.....	26
Figure 3.1 The conceptual framework adopted by the study: A comprehensive model of educational system.....	54
Figure 5.1 Mean score (%) of the 42 Grade 9 learners who wrote mathematics in the three schools in 2016, 2017 and 2018.....	90

## Abbreviations

ACE	Advanced Certificate in Education
ANA	Annual National Assessment
AMESA	Association of Mathematics Educators of South Africa
DoE	Department of Education
FET	Further Education and Training
GET	General Education and Training
HoD	Head of Department
IQMS	Integrated Quality Management System
KZN	KwaZulu-Natal
NCS	National Curriculum Statement
OECD	Organisation for Economic Co-operation and Development
PCK	Pedagogical Content Knowledge.
TIMSS	Third International Mathematics and Science Study
VUMA	Vula Mathematics
WMCS	Wits Maths Connect Secondary

## Abstract

The main aim of this research was to explore Grade 9 learners' mathematics performance in schools where teachers participated in the 1+9 programme, which was designed to equip teachers with strategies to teach mathematics in the Senior phase(Grade 7-9). This study is guided by the qualitative method within an interpretive paradigm. The conceptual framework adopted by the study is a compressive model of the education system (Shalveson, 1989). This study took place in three schools selected from uMgungundlovu District in KwaZulu-Natal, using two data collection methods, namely the document review where the researcher took the marks schedules of the grade nine learners for the year 2016, 2017 and 2018. The researcher then randomly selected that marks of 42 learners in each of the three school, put them in tables and graphs to compare the performance in each of these years. In the second method the researcher conducted the interviews with ten learners and three teachers that were part of the 1+9 programme.

Guided by the aim of the study, the following objectives underpinned this research: (i) To determine the extent of improvement in learner performance in mathematics post the 1+9 programme; and (ii) To determine the Grade 9 learners' competence to solve mathematical problems after their teachers took part in the 1+9 programme. In order to unpack the objectives and carry out an in-depth analysis of the phenomena of this study, which is exploring Grade 9 learner performance post the introduction of the 1+9 programme, throughout this study the researcher asks the following research questions: (a) How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level?and (b) What do Grade 9 learners' written responses reveal about their competency in mathematics after the implementation of the 1+9 programme?

The research findings reveal that the development programme for teachers must be continuous, to ensure that they are up to date with the current status of mathematics, so that they will implement the current knowledge for teaching. The findings that have resulted from this study will serve to recommend to professional development organisations, the Department of Basic Education and

other stakeholders that professional development of teachers takes place to ensure that they use the trackers, lesson preparation plans and pace setters, and have a common assessment each term in Grade 9, to ensure that the teaching and learning of mathematics is taken seriously. The findings of this research could serve to encourage the Department of Education and the Departmental Head to carry out thorough monitoring of the educators' work, to ensure that it is done properly.

## TABLE OF CONTENTS

	<b>Page</b>
Declaration	2
Acknowledgements	3
Dedication	4
List of tables	5
List of figures	6
Abbreviations	7
Abstract	8

### **Chapter One: Background, Problem statement and Rationale for the study**

1.1 Introduction.....	17
1.1.1 The performance of learners in mathematics in National Curriculum Statement (NCS).....	18
1.1.2 The status of mathematics in KwaZulu-Natal.....	20
1.1.3 The performance per district of KwaZulu-Natal in Mathematics.....	21
1.1.4 The Annual National Assessment (ANA) performance by learners in Mathematics.....	24
1.2 Background .....	25
1.3 Rationale for the study.....	27
1.4 Purpose of the study .....	29
1.5 Problem statement.....	30
1.6 Significance of the study.....	31

1.7	The role of mathematics .....	32
1.8	Research objectives and research questions.....	33
1.9	Location of the study .....	34
1.10	Overview of the thesis.....	34
1.11	Conclusion.....	36

## **Chapter Two: Literature Review**

2.1	Introduction.....	37
2.2	Professional development programmes addressing mathematical Knowledge for teaching.....	37
2.2.1	Wits Maths Content Secondary.....	38
2.2.2	Association of Mathematics Educators of South Africa.....	39
2.2.3	The Advanced Certificate in Education in Mathematics in FET.....	40
2.3	The impact of teachers' mathematical proficiency on mathematics performance.....	41
2.4	Teacher proficiency and learner attainment.....	42
2.4.1	Proficient teachers are quality teachers: What is a quality teacher?.....	43
2.5	Teachers' qualifications.....	43
2.6	Mathematics anxiety and mathematics performance.....	45
2.7	The impact of self-efficacy in mathematics performance.....	47
2.8	Attitude towards mathematics learning.....	48

2.9 The impact of curriculum coverage on mathematics performance.....	48
2.10 Conclusion.....	49

### **Chapter Three: Conceptual Framework**

3.1 Introduction .....	51
3.2 Model for the conceptual framework.....	53
3.2.1 Inputs.....	54
3.2.2 Teachers’ knowledge.....	56
3.2.3 Students’ knowledge.....	57
3.3 The process.....	57
3.3.1 Curriculum quality.....	57
3.3.2 Ten Characteristics of a good curriculum.....	58
3.3.3 Advantages of centrally based curriculum development.....	59
3.3.4 Teacher content knowledge.....	60
3.3.5 Quality mathematics instructions.....	60
3.4 The outputs.....	61
3.4.1 Mathematics achievements.....	61
3.4.2 Mathematics performance.....	62

3.4.3 Attitude and aspiration.....	63
3.5 Conclusion.....	64

## **Chapter Four: Research Methodology**

4.1 Introduction.....	65
4.2 Study setting.....	66
4.3 Critical research questions.....	67
4.4 Research paradigm.....	67
4.4.1 Suitability of the interpretive paradigm for this study.....	69
4.5 Research Approach.....	70
4.5.1 Suitability of qualitative approach for this study.....	70
4.6 Research Design.....	72
4.6.1 Suitability of case study research for this study.....	73
4.7 Sampling and sampling procedure.....	73
4.8 Data collection methods.....	74
4.8.1 Document review.....	75
4.8.2 Semi-structured interviews.....	76
4.8.3 Suitability of data collection methods for this study.....	76
4.9 Data analysis.....	78
4.10 Ethical issues.....	79

4.11 Trustworthiness.....	81
4.12 Limitation of the study .....	81
4.13 Conclusion.....	82

## **Chapter Five: Data Presentation and Analysis**

5.1 Introduction.....	83
5.2 Data presentation and analysis of learners’ performance.....	84
5.3 Presentation of data from interviews with the teachers.....	91
5.4 Presentation of data from interviews with learners.....	96
5.5 Inductive analysis of teachers’ interview responses .....	99
5.5.1 Resources.....	100
5.5.2 Teachers’ knowledge.....	100
5.5.3 Student knowledge.....	101
5.5.4 Curriculum quality and curriculum coverage.....	101
5.6 Emerging themes from the teachers’ interview responses.....	101
5.7 Participation in professional development programmes, including the 1+9 programme..	102
5.8 Inductive analysis of learners’ interview responses.....	105
5.9 Conclusion.....	107

## **Chapter Six: Discussion and Conclusion**

6.1 Introduction.....	108
6.2 Main objectives of the study.....	108
6.3 Results for mathematics from the document review for 2016, 2017 and 2018.....	108
6.4 What are teachers' perceptions regarding mathematics performance after the 1+9 programme?.....	109
6.4.1 Teachers' qualifications and experience as well as understanding of the 1+9 programme.....	109
6.4.2 Teachers' perceptions of the declining mathematics results.....	111
6.4.3 The 1+9 programme improves the content knowledge and conduct of teachers.....	112
6.5 These are the learners' perceptions regarding mathematics performance after the 1+9 programme.....	113
6.6 Recommendations.....	115
6.7 Limitations .....	116
6.8 Conclusion.....	116
<b>References.....</b>	<b>117</b>

**Appendices**

Appendix I: Interview questions guide: Questions for the teachers.....130

Appendix II: Interview questions guide: Questions for the learners..... 131

Appendix III: Letter to the principals.....132

Appendix IV:Ethical Approval.....133

Appendix V: Turnitin Report.....134

Appendix VI:...Participants Consent forms-Learners.....135

Appendix VII. Participants Consent forms-Learners.....138

# Chapter One

## Background, Problem statement and Rationale for the study

### 1.1 Introduction

Literature and anecdotal evidence have revealed that mathematics has become a subject that requires particular consideration because of poor learner achievement (Third International Mathematics and Science Study (TIMSS), 2015); Department of Basic Education, 2014, 2017; Ndlovu, Amin & Samuel, 2017). Studies conducted in different countries revealed different factors that influence poor performance of learners in mathematics (Makgato & Mji, 2006; Center for Development in Education, 2014; Pournara, Hodgen, Adler, & Pillay, 2015). Mji and Makgatho (2006) identify teacher knowledge as one of the reasons leading to poor learner performance. In support of these authors, Pournara et al. (2015) argue that teachers who have good subject matter knowledge tend to be more effective in their teaching and vice versa, thus influencing learner achievement. Ball (2017) posits that the work of teaching is more than just delivering the lesson; it requires teachers' attention to four facets that contribute to learning, that is, the learner, teacher, content and environment.

The argument by Ball (2017) to a certain extent supports findings by the Organisation of Economic Co-operation and Development (OECD) (2014) which showed that other than teacher knowledge, there are lots of factors leading to learner poor performance, which include learners' socio-economic issues. This suggests that there is more to teaching and learning other than delivering the lesson. While many studies articulate different factors and suggest different interventions, in South Africa the status of poor learner performance in mathematics is still a cause for concern, as shown in Figures 1.1, 1.2 and 1.3 below, and literature suggests the need for research that targets the improvement of classroom instruction (Jojo, Joseph, Dhlamini, Phoshoko, & Ngoepe, 2013).

### 1.1.1 Performance of learners in Mathematics in the National Curriculum Statement (NCS)

The lack of testing in Grade 9 resulted in the study being motivated by looking at the Grade 12 National Curriculum Statement (NCS). The results for Grade 12 that are used as motivation are from the years 2016, 2017, and 2018. The bar graphs below will show the number of learners who enrolled in Grade 12 in a particular year in all nine provinces of South Africa, and also look at the performance in each province. The Grade 12 mathematics results are influenced by the performance of learners in Grade 9, so this makes for a correlation between the results in these grades. From the experience of teaching, if learners in Grade 9 do well in mathematics, they are highly likely to choose mathematics in the Further Education and Training (FET) phase from Grade 10 to 12 (KwaZulu-Natal [KZN] Department of Education [DoE], 2017). Figure 1.1 shows the number of Grade 12 learners who enrolled and wrote mathematics in the years 2016, 2017, and 2018 in South Africa.

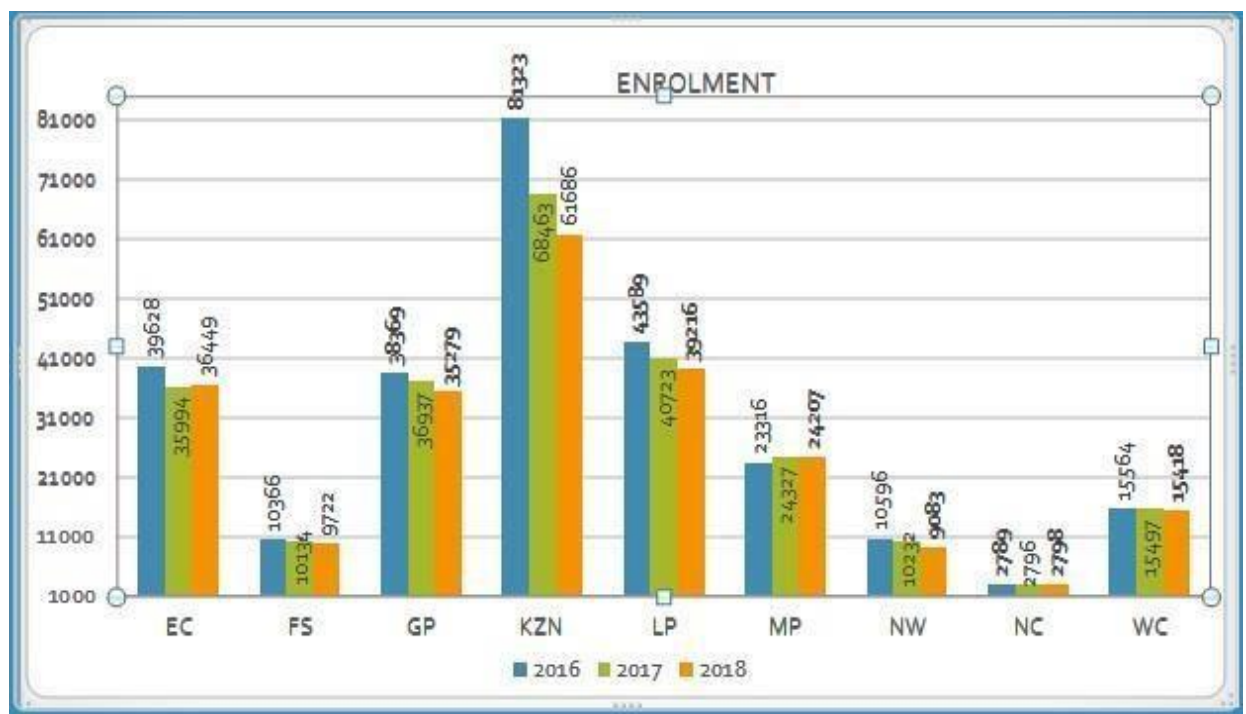
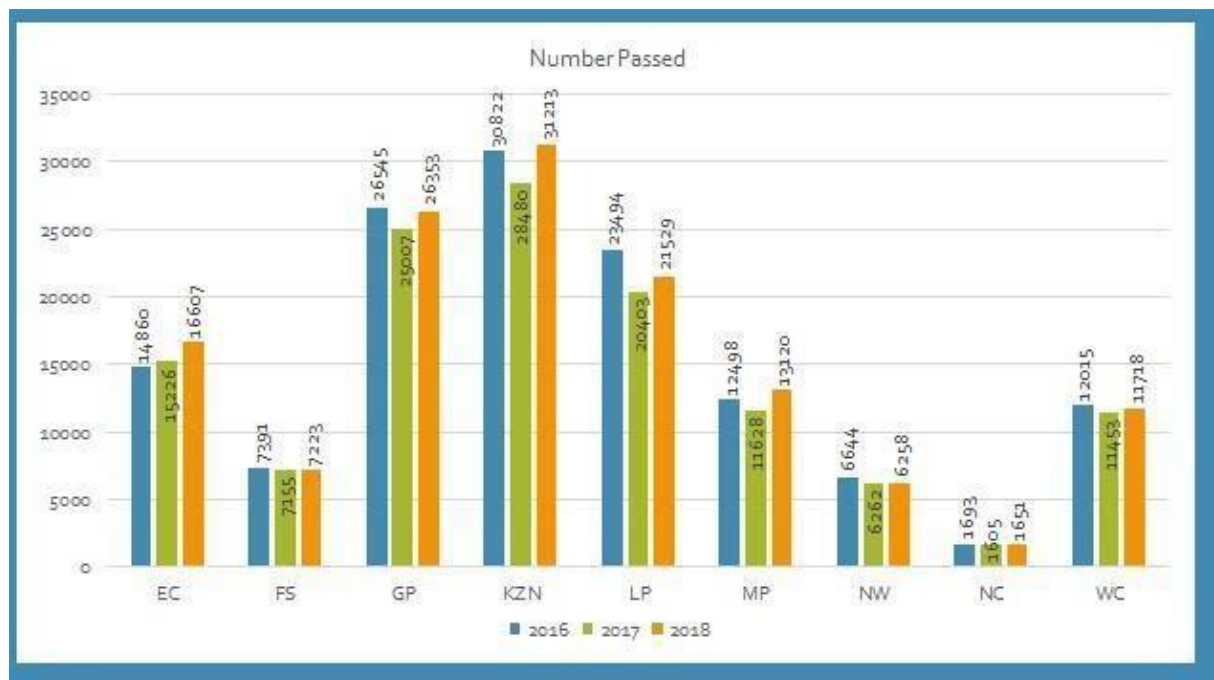


Figure 1.1: Number of Grade 12 learners who enrolled for and wrote mathematics in the years 2016, 2017 and

**2018, by province. (KZN Department of Education (DoE), 2018).** EC = Eastern Cape, FS = Free State, GP = Gauteng, KZN = KwaZulu-Natal, LP = Limpopo, MP = Mpumalanga, NC = Northern Cape, WC = Western Cape.

According to Figure 1.1, KZN province always had the highest number of Grade 12 learners writing the subject of mathematics in 2016, 2017 and 2018: a record of number of 81 323 in 2016, 68 463 in 2017 and then dropping to 61 686 in 2018. KZN is also the province with the highest number of schools in rural communities. Schools in the rural communities are classified as disadvantaged schools which lack resources, with shortages of well-qualified mathematics teachers, floor space, water and sanitation, and proper toilets (they either have pit toilets or no toilets). Some of these schools are situated deep within the villages, where there is a lack of infrastructure such as roads. This makes it difficult to reach the schools because the roads are gravel and become muddy when it rains, then one has to walk to be able to reach these schools.



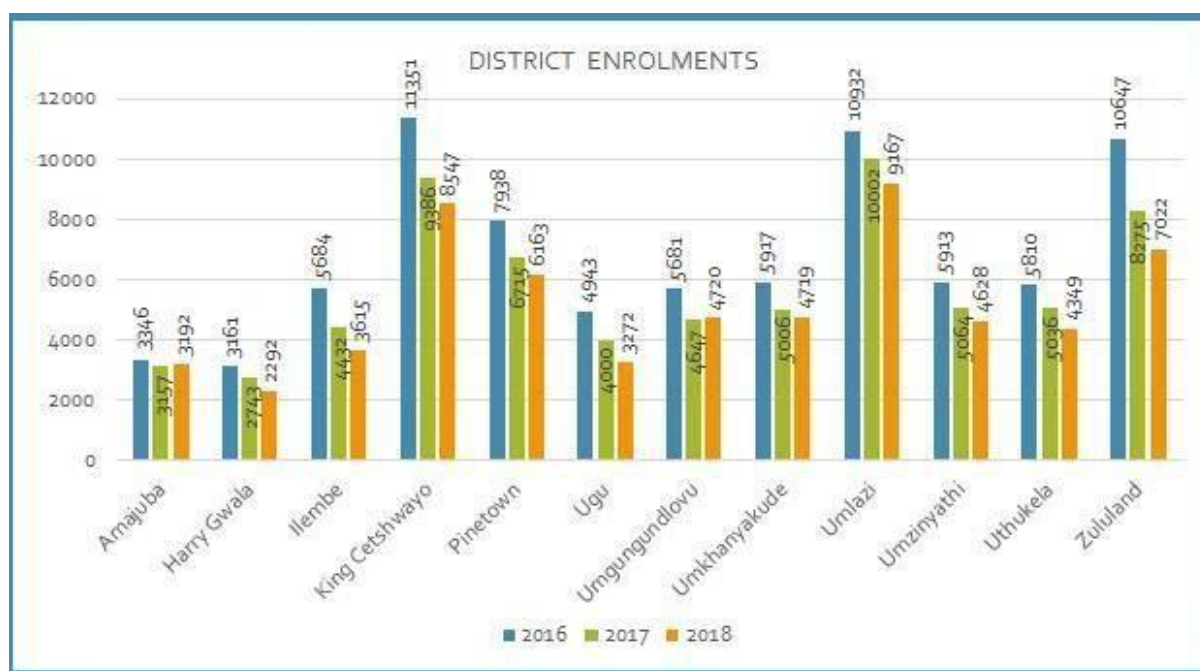
**Figure 1.2: Grade 12 learners who passed mathematics in each province in South Africa, 2016, 2017 and 2018(KZN Department of Education (DoE), 2018).** EC = Eastern Cape, FS=Free State, GP = Gauteng, KZN = KwaZulu-Natal, LP = Limpopo, MP = Mpumalanga,NC=Northern Cape, WC = Western Cape.

The schools which are under-resourced are always expected to somehow produce the same results as the schools which are well-resourced and in the urban areas. The South African

Curriculum is centralised; this means that the school curriculum is the same for all learners in the country. Figure 1.2 shows the number of learners who wrote and passed mathematics in Grade 12 in the nine provinces of South Africa in 2016, 2017 and 2018. It shows that in 2016, of the total number of 81 323 learners who wrote mathematics, 30 822 of them managed to pass, meaning that 50 501 failed. In 2017, out of 68 463 learners who wrote mathematics, 28 480 passed and 39 983 failed, and in 2018 out of 61 686 who wrote mathematics, 31 213 learners passed and 30 213 failed. These numbers are not promising and show that something needs to be done. The South African Government, non-governmental organisations (NGOs) and other stakeholders who are in power need to stand up and do something about this situation. The 1+9 campaign is one of the initiatives that the Government of the country is using to try and minimise the gap between the number of learners who write mathematics and the number who pass. The 1 + 9 programme was when a teacher spent one day in the teacher development workshop, and nine days teaching learners in the classroom at school.

### **1.1.2 The status of mathematics in KwaZulu-Natal**

The performance of learners in mathematics in KZN is overwhelmingly low, due to the factors that have been mentioned above. Figure 1.3 displays the number of learners in the 12 urban districts of KZN, but there are schools from locations with informal settlements where there is no culture of teaching and learning. Those schools are mostly dominated by gang violence, and it is difficult to promote and influence the teaching and learning. Teachers also find it difficult to deliver the curriculum to learners who are under the influence of drug and alcohol abuse in such schools.



**Figure 1.3: Grade 12 learners who wrote mathematics examinations in 12 districts in KZN in 2016, 2017 and 2018 (KZN Department of Education (DoE), 2018).**

UMgungundlovu contributes an average number of learners who enrol for mathematics in each of the years from 2016 to 2018, compared with other districts. The uMgungundlovu District is composed of 150 high schools, about 15% of which are urban schools, with about 25% being semi-urban schools and about 60% more rural schools. King Cetshwayo is the largest district with more rural schools; the Zululand, UThukela UMkhanyakude and UMzinyathi Districts also contribute have many rural schools, with many of the learners coming from difficult backgrounds. Umlazi and Pinetown are mostly urban in nature. This motivated the managers of the 1+9 programme to implement it in the rural schools in the uMgungundlovu District, because it was a success in rural districts such as Amajuba and others in KZN.

### **1.1.3 Performance in mathematics per district of KwaZulu-Natal**

In terms of performance, Amajuba District is leading even though they have many rural schools; their schools are improving and the 1+9 programme was implemented in the General Education and Training (GET) phase, and was seen to bear fruit in the matric NCS results. The study is

motivated by the poor performance in mathematics of Grade 12 learners in the more rural districts of KZN see (Figures 1.4, 1.5 and 1.6).

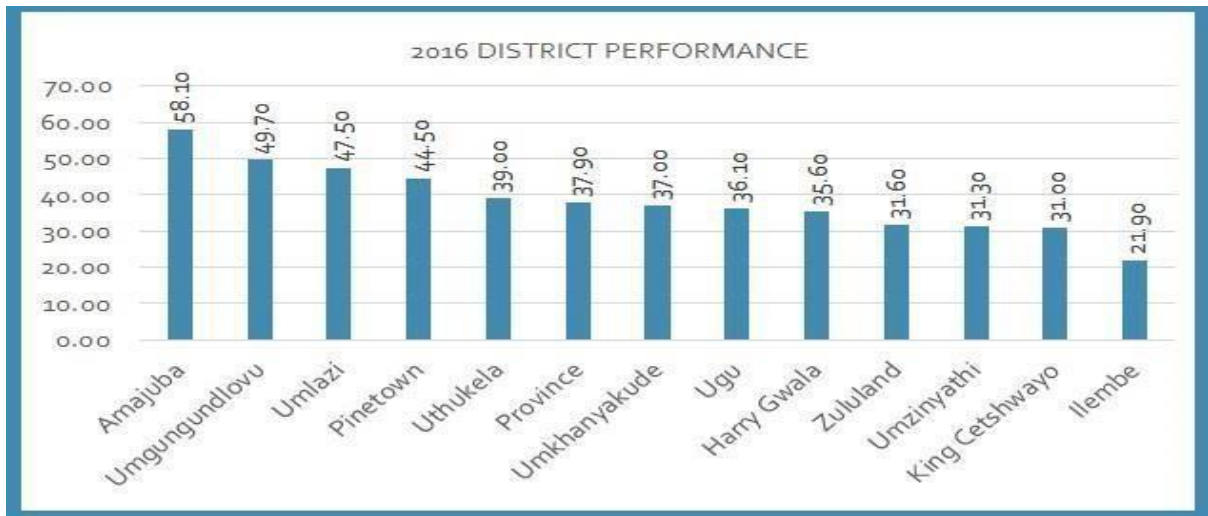
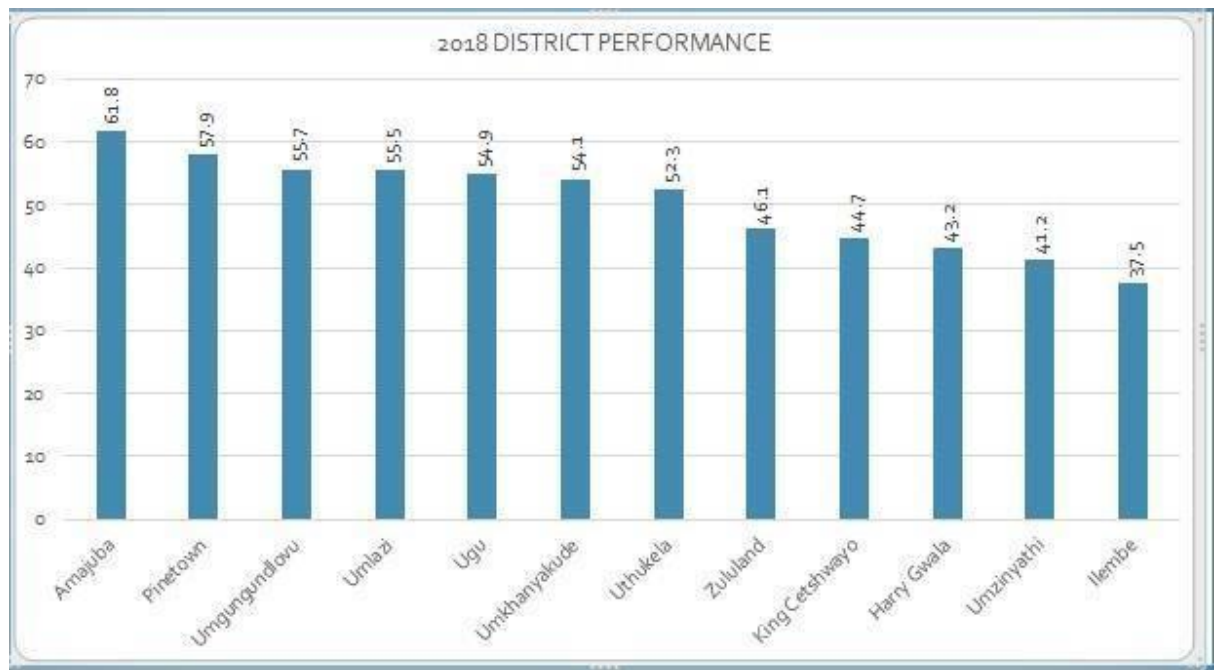


Figure 1.4: Average performance (%) of Grade 12 learners who wrote mathematics examinations in 12 districts in KZN in 2016 (KZN DoE, 2018).



Figure 1.5: Average performance (%) of Grade 12 learners who wrote mathematics examinations in 12 districts in KZN in 2017 (KZN DoE, 2018).



**Figure 1.6: Average performance (%) of Grade 12 learners who wrote mathematics examinations in 12 districts in KZN in 2018 (KZN DoE, 2018).**

The most rural districts contribute highly to the failure rate, even those that have the lowest number of learners enrolled in mathematics, such as Ilembe uMzinyathi and Harry Gwala. In Ilembe District in 2016 there were 5682 learners who wrote the mathematics examination in Grade 12, and they achieved an average mark of 21%; in year 2017 they had 4432 learners who wrote, with an average mark of 27.1%, while in 2018 there were 3615 learners who wrote with an average mark of 37.5%. In UMzinyathi District in year 2016 there were 5913 learners who wrote mathematics, and they achieved an average mark of 31%; in 2017 there were 5064 learners who wrote, who achieved an average mark of 33.6%, and in 2018 there were 4628 learners who wrote the mathematics examination and achieved an average mark of 41.5%.

In Harry Gwala District in 2016 there were 3161 learners who wrote the mathematics examination and they achieved an average mark of 31.3%, while in 2017 there were 2743 learners who wrote mathematics and they achieved an average mark of 34.8%, and in 2018 there were 2292 learners who wrote mathematics they achieved an average mark of 43.2%.

These districts have fewer numbers of learners than others, but they have more schools in the deep rural areas where there are more problems.

#### 1.1.4 Annual National Assessment performance of learners in mathematics

Table 1.1 presents the Annual National Assessment (ANA) average mathematics marks for learners from 2011 to 2014 for Grades 1 to 6, and from 2012 to 2014 for Grade 9. The analysis of results for from Grade 1 to Grade 6 shows that there is a little improvement across the years, but for Grade 9 there is no improvement across the years. The lack of a standardized examination in the lower grades after 2014 makes it difficult to observe if there is any improvement in learner performance post-2014 in Grade 9. However, if the Grade 12 results are anything to go by, this suggest that the crisis depicted in Table 1.1 continues to persist.

**Table 1.1: Average marks in mathematics (%) by grade for the Annual National Assessment (ANA), 2011–2014 (Department of Basic Education, 2014)**

Grade	2011	2012	2013	2014	Grade averages across 2011– 2014
1	63	68	60	68	64.74
2	55	57	59	62	58.25
3	28	41	53	56	44.5
4	28	37	37	37	34.75
5	28	30	33	37	32.0
6	30	27	39	43	34.75
9	N/a	13	14	11	12.6 (2012–2014)

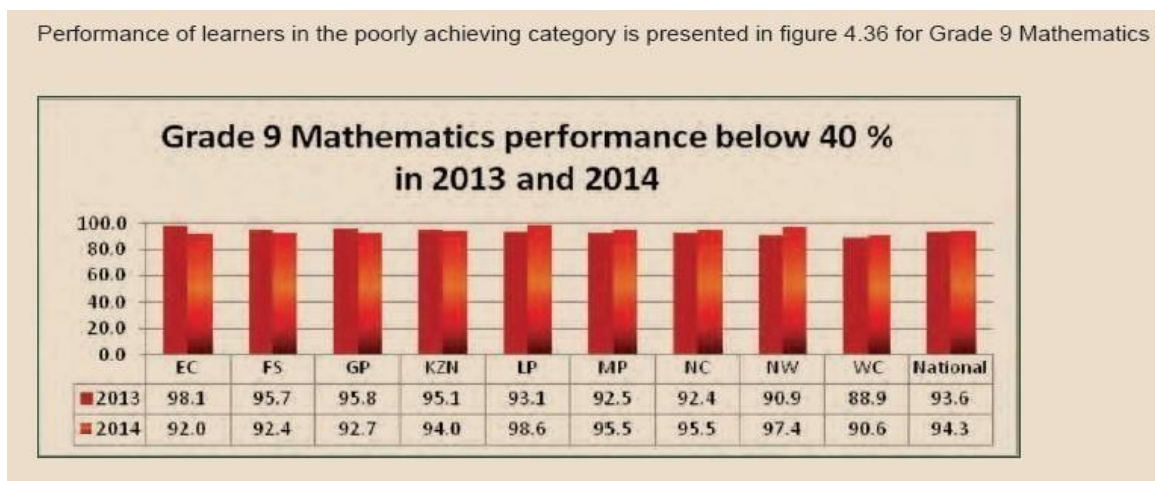
The ANAs which were phased out nationally, uncovered the degree of learning deficiencies in South African primary schools (Graven, 2016). Table 1.1 shows the decreasing trend in the ANA results from 2011, as noted. The decline in results every year in South African schools shows that learners are unable to deal with mathematics at school level. This crisis is confirmed by the announcement by the Department of Basic Education that learners with a 20% mark in mathematics can be condoned to move to Grade 10, provided they passed the other subjects (DoE, 2016). According to the DoE (2012), the pass requirements for mathematics in Grade 9 was 40%, and learners with 35% could be condoned provided they passed the other subjects. Lowering the condonation requirements to 20% suggests that the DoE is acknowledging that the epidemic of poor learner performance in mathematics still persists.

Even though we noticed improvement in the Grade 12 overall pass mark over the past years in the province of KZN, in the uMgungundlovu district to be precise (KZN DoE, 2018), the truth is that not much improvement has been noted when it comes to mathematics. As a result, there is still a huge gap between South African learners when they compete internationally with other learners in mathematics. This is why South Africa as a country are running short people that possess scarce skills such as in science and technology fields or sector.

## **1.2 The Background**

The analysis of the ANA showed that Grade 9 learners were performing very poorly in mathematics, with the country's average mark at 11% and 13% in 2013 and 2014 respectively, and the majority of learners performing below 40%. The province of KZN had 95.1% of learners in 2013 performing below 40%, with a 1% improvement in 2014. The evidence of this is presented

in Figures 1.7 and 1.8 below. Figure 1.7 displays the percentage of learners achieving below 40% nationally in mathematics in 2013 and 2014, and Figure 1.8 shows the performance of learners in mathematics by average mark in KZN districts.



**Figure 1.7: Performance of learners (% scoring below 40%) in the ANA 2013 and 2014 in the nine provinces (Department of Basic Education, 2014).**

AMAJUBA	13.0	8.3
ILEMBE	12.3	9.8
PINETOWN	15.0	10.8
SISONKE	15.1	13.1
UGU	11.0	7.5
UMGUNGUNDLOVU	14.8	10.6
UMKHANYAKUDE	11.3	9.2
UMLAZI	17.4	12.3
UMZINYATHI	17.7	14.7
UTHUKELA	15.1	9.8
UTHUNGULU	12.9	10.2
ZULULAND	15.8	12.0

**Figure 1.8: Performance of learners in the ANA 2013 and 2014 in each district in KZN province (Department of Basic Education, 2014).**

The performance of South African learners in mathematics is also documented in international reports, e.g. the Third International Mathematics and Science Study (TIMSS) (2015). In an attempt to mitigate the situation, there have been many interventions aimed at teacher development. It is believed that as the world keeps on changing, so the knowledge of teachers needs to be developed to keep up the standard of education (Pournara, Hodgen, & Pillay, 2015). Since the dawn of democracy there has been an ever-changing curriculum in South Africa therefore, there is a need to empower teachers with methodologies to teach. Taking this notion to task, the Department of Basic Education in KZN implemented the 1+9 programme (2015 and 2016), which was meant to improve mathematics performance of grade 9 learners through the enhancement of teachers mathematical knowledge and instructions.

In 2017 the Department of Basic Education in KZN shifted the programme to Grade 7. However, no in-depth study was done to explore its effectiveness in Grade 9 before it was shifted to Grade 7. Although it is tempting to evaluate the intervention, the major concern is learner performance. Therefore, this study aimed to explore Grade 9 learner performance in mathematics after the implementation of the 1+9 programme in Grade 7. Although the aim is not to evaluate the intervention programme, findings from this study are mostly significant in understanding the extent to which the intervention has assisted in improving mathematical instruction, thus enhancing the teaching and learning process, and in turn enhancing learner performance. Moreover, the aim is to understand the improvement in learner performance in mathematics in the senior phase since the introduction of the 1+9 programme to Grade 7 in 2017.

### **1.3 Rationale for the study**

Mathematics is considered as a major requirement for learners to be admitted to university to study towards careers that are considered as professions. Therefore, learners' performance in mathematics is deemed crucial in opening doors to life post-matric. However, in South Africa over the years we have been faced with an epidemic of poor learners' performance in the subject. Many interventions have been implemented with the aim of addressing this; however, a deficiency is that while one intervention (the 1+9 programme) has been put in place, studies

have not been done to explore its effectiveness after its implementation or to explore whether the main goal is achieved.

As mentioned above, this study does not aim to evaluate the success or failure of the 1+9 programme; rather, its main aim is to explore learner performance after the 1+9 programme, since there are no assessments that could be analysed and provide the country with findings to show the impact on the performance of learners. Even the decision on condonation of learners who have achieved 20%, that is the current position of the DoE with regard to learner performance in Grade 9 mathematics, is not supported by empirical research. The 1+9 programme was aimed at equipping teachers with methodologies to teach mathematics, in order to improve learner performance in mathematics. In order to understand learner performance post the 1+9 programme, this study unpacks learners' performance in mathematics before implementation of the 1+9 programme and after the programme, to explore its effectiveness in terms of learners' performance.

As a mathematics teacher and head of department, understanding the effectiveness of the 1+9 programme regarding learner achievements is of the utmost importance, because the enabling factors can be used to enhance performance in other grades and challenges can be addressed before escalating, thus curbing the crisis of continually poor performance in mathematics. It has been the trend in South Africa that we come to know about implementation of interventions, but nothing much is said about the effects on the teaching and learning process.

The main motivation of the study is finding out the impact that the 1+9 programme had on learners' performance in terms of results. I strongly believe that if most of the challenges that we sit with as mathematics educators can be clearly outlined, explained, clarified, solved, attended to and addressed, at an early grade of high school like Grades 8 and 9, by the time learners reach Grades 10, 11 and 12 the majority will have a great chance of performing well in their final Grade 12 examinations. Therefore, the study will look into the impact that the programme had on the schools in the district which it was implemented in.

## **1.4 Purpose of the study**

The main purpose of the study is to explore the performance of Grade 9 learners in mathematics after the implementation of the 1+9 programme. The programme started as 1+4, where teachers in clusters plan together how to teach a particular topic to be covered within a week, following the curriculum. It was later changed to 1+9, where a teacher teaches for 9 days and meets with other teachers in his/her cluster for planning on one day in two weeks.

However, since its inception not much has been done to explore learners' performance. This is because the ultimate goal of the 1+9 programme was to enhance teachers' performance through helping teachers with methodologies to teach. The programme was implemented in some districts in the province of KZN and slight improvement was witnessed, so it was taken to other districts such as uMgungundlovu and others.

The study is considering that the reasons learners are not doing well in Grade 12 is because some of them started to do poorly in the lower grades. If a learner is performing well in mathematics in lower grades like Grades 8 and 9, that learner stands a good chance of doing well as he or she proceeds to Grades 10, 11 and 12. This is why the study is looking into an intervention programme that was mainly for Grade 9 educators, to investigate whether there has been a change in the performance of learners that were in the hands of the educators who attended the 1+9 programme in 2015. If there is an improvement, it will be seen if this can be linked with the results of the efforts of the 1+9 programme. Both learners and educators will be interviewed to find out the level of improvement after the 1+9 programme. If there are high levels of improvement from interventions like the 1+9 programme in the lower grades, its use will have to be considered in many other schools, districts and provinces which are performing poorly in mathematics.

Furthermore, one of the study's purposes is to explore what occurs when a teacher is trained or sent on various programmes and workshops: the knowledge that they obtain during the sessions, what challenges they often come across as they bring a slight change to the content as they implement the new information that they have obtained. Intervention programmes are mainly for educators, driven by facilitators who have a strong belief that when an educator is well

trained or well equipped, the content will be understood much better by the learners, and that will be observed through learners' performance. However, recently in provinces such as KZN there have been programmes where learners that are doing well in mathematics and other demanding subjects are grouped together and sent to a camp for final examination preparations.

## **1.5 Problem statement**

Examination of the ANAs uncovers the degree of the learning deficiencies in South African primary schools (Graven, 2016). The decline in results in South African schools every year shows that learners are unable to deal with mathematics at school level. In South African education mathematics is regarded as a subject that is scarcely tackled, alongside technology and physical sciences, because South Africans perceive mathematics to be a difficult subject (Du Preez, 2018). The researcher specifically chose grade 9, because it is the grade where we lose too many learners to mathematical literacy. Grade 9 is regarded as a bridge between a Further Education Phase and General Education Phase, when a learners did not do well in in mathematics grade 9, then he is advised not to choose mathematics in Grade 10..

Studies conducted on learners' performance in mathematics across in various countries have indicated that a majority of learners are mathematically challenged. These studies will be discussed in detail in Chapter Two, the literature review. In the literature Bansilal, Brijlal and Mkhwanazi (2014), Shalem, Sapire and Sorto (2014), Aksu and Umit (2016), Mkhwanazi, Ndlovu, Ngema and Bansilal (2018) and Malambo, van Putten, Botha and Stols (2018) hold that expansion of teacher knowledge is needed for the improvement of learner attainment. This teacher knowledge can be knowledge of the subject, knowledge of effective instruction or knowledge of managing curriculum, among others, all (but not limited to) of which are needed for the improvement of learner attainment. The findings during and post the ANA period suggested that attention to teacher mathematical knowledge for teaching is needed in order to enhance learner performance. In response to the recommendations that emerged from the ANA results, the DoE introduced the 1+9 programme in 2015, as mentioned above.

However, since the introduction of the 1+9 programme not much has been noted regarding learner performance. There is a possibility that there has been an improvement – but since the ANA ceased in 2014 there is no standardised examination, except in Grade 12. This makes it difficult to explore the extent of improvement in learner performance in the lower grades post ANA and since the introduction of the 1+9 programme in Grade 7. Introducing an intervention and not researching the extent to which it has achieved its goal can be detrimental to the success of the education system. It is within this premise that the researcher deemed it necessary to explore Grade 9 learners' performance in mathematics after the introduction of the 1+9 programme.

## **1.6 Significance of the study**

The literature gathered for this study has revealed that much work that has been done on education in mathematics in many countries. Through the use of the theory of change, this study will focus on Grade 9 learners' performance after the introduction of the 1+9 programme to their educators in 2015. The study is expected to find the extent to which the 1+9 programme impacted on the educators' ways of teaching mathematics in the classroom, which will be investigated by comparing the results of the learners before and after the programme.

As noted above, many authors (Bansilal et al., 2014; Shalem et al., 2014; Uksu & Umit, 2016; Mkhwanazi et al., 2018; Malambo et al., 2018) state that the expansion of teacher knowledge is needed for the improvement of learner attainment. The results of this study will contribute to the world of mathematics by revealing the results of learners who are taught by teachers who received the 1+9 programme. These results will best indicate the extent to which a teacher who has received some enhancement in terms of knowledge, is in a better position to empower learners to do better in mathematics. It is hoped that these teachers would not only enhance learners' performance, but also empower other educators in the field of mathematics. The findings during and post the ANA period suggested that attention to teachers' mathematical knowledge for teaching is needed in order to enhance learner performance. One of the points of training in mathematics is also to build up learners' information, competency and enthusiasm for the branch of knowledge. Accomplishment in mathematics is held in high esteem in the

public arena; achievement in mathematics is seen as a reflection of mental knowledge. More opportunities are available to learners and students who exceed expectations in mathematics than to those individuals who do not (Jojo, Dhlamini, Phoshoko & Ngoepe, 2013)

Therefore, much emphasis is placed on mathematics and mathematics training in school and in the public eye. Accomplishment in secondary school mathematics will in general be held in high esteem in South Africa.

## **1.7 The role of mathematics**

Mathematics is a key subject that stretches out past the school years, and has regularly been alluded to as the most critical subject (DoE, 2002). Mathematics assumes a noteworthy role in our everyday lives. Mathematics teachers are tasked with the responsibility of ensuring that learners meet the requirements for a pass and that they can compete globally (DoE, 2002). As posited by the changed NCS (DoE, 2002), mathematics is a human movement that includes watching, speaking to and examining designs and quantitative connections in physical and social marvels and between scientific items themselves. Being numerically proficient empowers one to contribute to and partake with trust in the public arena. Likewise, educating in mathematics looks to advance values that support self-improvement, as well as a national South African personality that is altogether different from that created by the previous, politically sanctioned racial segregation in training (DoE, 2002).

The mathematics educational modules, as endorsed in the Revised National Curriculum Statement (DoE, 2002), look to make for a deep-rooted student who is sure and autonomous, proficient, numerate, multi-talented, caring, mindful of nature, and can take an interest in the public eye as a dynamic subject. Teachers and other role players in mathematics training need to take cognizance that mathematics means to build up the following in the student: basic attention to how scientific connections are utilised in social, ecological, social and financial relations; gratefulness for the magnificence and class of mathematics; and a soul of interest in and adoration for mathematics (DoE, 2002). With an end goal to make, promote and maintain adoration for science, teachers need to enable students to conquer mathematics anxiety.

In this profoundly mechanical time, mathematics is fundamental; those students who excel in it are very prepared to address the requirements and difficulties of our globalised society. The 1+9 is also a programme that revives knowing the importance of mathematics in learners. The role of teachers is to ensure that learners understand the importance of mathematics as a subject; if most learners understand that, then the teacher will have fewer problems to deal with in his or her classroom (DoE, 2002).

## **1.8 Research objectives and research questions**

The researcher deemed it necessary to explore the performance of Grade 9 learners in mathematics after the introduction of the 1+9 programme aiming to improve mathematical knowledge for teaching, which in turn aimed to improve learner performance in mathematics. Guided by the aim of the study, the following objectives underpinned this study:

- To determine the extent of improvement in learner performance in mathematics post the 1+9 programme.
- To determine the Grade 9 learners' competence to solve mathematical problems after their teachers took part in the 1+9 programme

In order to unpack the objectives and do an in-depth analysis of the phenomena of this study, which is exploring Grade 9 learner performance post the introduction of the 1+9 programme, throughout this study the researcher asks the following research questions:

- How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level?
- What do Grade 9 learners' written responses reveal about their competency in mathematics after the implementation of the 1+9 programme?

## **1.9 Location of the study**

The study is conducted in three schools in the uMgungundlovu District. The three schools were part of the 1+9 programme in the years 2015 and 2016. Two schools are in the Elandskop Circuit (for ethical purposes the researcher has decided to call them school A and school B and one school is in the Sweetwater Circuit (school C). The Grade 9 mathematics teachers in these three schools all attended the 1+9 programme at Vulindlela Education Centre every fortnight from the beginning of 2015. In the uMgungundlovu District schools from rural and semi-rural areas were considered the poorest-performing schools in mathematics; therefore, the schools chosen are considered to be either rural or semi-rural.

## **1.10 Overview of the thesis**

This study is divided into six chapters. Chapter One provides an introduction to what the study is all about. The researcher also discusses and describes the structure of this study. This study outlines the geographical background of the participants, the motivation and the rationale for the research project, the importance of mathematics, the role of mathematics, the problem statement, the research questions and the objectives.

Chapter Two presents the literature review. The researcher describes the means by which the Government and the NGOs and international communities help to develop teachers in order to help improve learners' performance in mathematics. The researcher describes the impact and the influence of various stakeholders such as NGOs, government organisations, and the international organisations in the country. The researcher outlines the role players in the education of mathematics in South Africa to improve mathematics performance in learners.

Some of these organisations are concentrating on the rural areas.

Chapter Three outlines the conceptual framework that is adopted by the study, which is a compressive model of the education system (Shalveson, 1989). The researcher uses this framework to carry out the study, to meet the objective and answer the research questions. The researcher then describes the significance of teacher mathematical proficiency, and the impact of this on the performance of learners in the classroom environment. The researcher presents

literature on some of the work that has been done in the development of educators, to improve the performance in their respective classrooms. The researcher also incorporate the theory of change to help answer the research questions and to achieve the aims of this study.

Chapter Four presents the methodology of the study. The qualitative paradigm was the preferred research method, with semi-structured interviews as the qualitative method of data collection. The researcher outlines the motivation as to why he chose qualitative methods for this study, and discusses the details of these methods of data collection. The researcher also discusses the sampling techniques used to select the participants, clearly explaining the reasoning behind this choice. Relevant literature is quoted and the grouping of participants is outlined.

The aims of conducting the interviews are also presented in this chapter, and the reasons for choosing learners and teachers as participants. The criteria followed in the purposive sampling are presented. The questionnaires that are administered during the interview sessions are discussed, with the reasons for asking such questions, aligning each question with the research objectives and research question. All of the research tools used during the research are discussed and presented in this chapter.

Chapter Five presents the findings and analysis. The researcher presents written responses from learners both before their teachers were involved in the 1+9 programme, as well after the teachers were involved in the programme. The coding of results and learners is outlined in this chapter, and the questions and answers from the voice-recorded interviews are presented. The information collected from the schools will be laid out using different tables and graphs. Interviews with particular learners and teachers were also included, to verify the information in each table, where necessary. Each school's responses were thoroughly analysed and compared to other schools' responses. The researcher outlines the responses to the key research questions, presenting the findings from different sources of data collection. Finally, the researcher outlines the responses to the key research questions.

Chapter Six provides a discussion of the results and the conclusion to this study. In this chapter the researcher aims to synthesise the data and answer the research questions. The discussion is presented based on the themes identified in Chapter Five. This chapter also presents the conclusion, recommendations and implications of the study.

### **1.11 Conclusion**

The aim of this chapter was to clarify the phenomena being studied. This was done by discussing the background to the study and its location, the rationale, and purpose of the study, the role of mathematics and the problem statement. In addition, the research objectives and research questions were discussed. In its essence, the chapter focused on explaining the significance of this study. The next chapter reviews the relevant literature, bringing to the fore notable findings related to this study.

## **Chapter 2**

### **Literature Review**

#### **2.1 Introduction**

In this chapter the researcher discusses the professional development programmes addressing mathematical knowledge for teaching. In this regard, the researcher first look into teacher development programmes that help teachers to improve the knowledge that they require in their teaching environment. The 1+9 programme is also a programme that was implemented to empower teachers with knowledge for teaching mathematics so that the mathematics results of learners improves. Secondly, the researcher looks at the impact of teachers' mathematical proficiency in mathematics performance. Thirdly, the impact of teachers' qualification on mathematics performance is explored. Fourthly, the researcher looks at the impact that mathematics anxiety and self-efficacy in learners have in their mathematics performance.

#### **2.2 Professional development programmes addressing mathematical Knowledge for teaching**

Researchers emphasise the need to put more effort into mathematical teacher development programmes as a means of improving the mathematics performance of learners (Jacob, Hill & Corey, 2017). The research question “How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level”? was addressed by looking at these development programmes. In South Africa there have been a number of professional development programmes focusing on addressing the teacher content knowledge for teaching. Some of these are the Wits Maths Connect Secondary (WMCS) project implemented by the University of the Witwatersrand in conjunction with the Gauteng DoE in the Johannesburg area, the Vula Mathematics (VUMA) Project in Hilton, Khanyisa Mathematics Project in Maritzburg College, Jika Imfundo, and the Association of Mathematics Educators of South Africa (AMESA). All of these, in conjunction with the DoE in KZN,

conduct content workshops for mathematics teachers. In addition, an Advanced Certificate in Education in Mathematics in the Further Education and Training (FET) band was introduced by the University of KwaZulu-Natal (UKZN) for FET and GET teachers to improve their pedagogical content knowledge (PCK).

### **2.2.1 Wits Maths Connect Secondary**

Wits Maths Connect Secondary (WMCS) was a five-year research and development project that aimed to improve the quality of mathematics teaching instruction and quality of performance by learners in mathematics. This project was administered by the National Research Foundation, funded by the First Rand Foundation and the Department of Science and Technology, and it ran from 2010 to 2014. It was implemented by the Gauteng DoE and supported the secondary school teachers who were teaching Grade 11 mathematics in one district in the Johannesburg area. The project was led by Professor Jill Adler, a leading researcher in mathematics education in South Africa and internationally. It was managed by Dr Craig Pournara and a team of experienced academic doctors and postgraduate students as facilitators.

A focal objective of the project was to fortify the mathematics pipeline inside each school, and from school to college. This implied aiming for more learners: to choose mathematics in Grade 10 and to succeed and qualify to study about mathematics-related courses at college. The professional work that is vital to this objective of backing mathematics teachers to enhance their mathematics content knowledge, the nature of their teaching and their insight and familiarity with the subject focused on educational programmes in mathematics.

The researchers associated with the WMCS conducted research after implementations of this programme, with results of learners pre- and post WMCS matched against others taught by educators who did not attend the programme. The impact of the programme was thus assessed among groups of learners in same school, taught by two groups of teachers (Pournara et al., 2015). The learners taught by teachers who attended the WMCS did well on the tests, the results

clearly indicating the difference between the two groups of teachers' ways of teaching mathematics in the classroom (Pournara et al. 2015). There was an improvement when the teaching was improved, whereby the learning was also improved.

### **2.2.2 Association of Mathematics Educators of South Africa**

Some teachers in South Africa improve their mathematics proficiency by being members of the Association of Mathematics Educators of South Africa (AMESA) for the enrichment of their mathematics teaching. AMESA is the professional association for and the voice of Mathematics education in South Africa, representing the interests of the discipline and its members at national and provincial level. Anyone who is interested in the teaching and learning of Mathematics at all levels can join this association.

The aim of AMESA is to promote mathematics education and enhance the quality of teaching and learning of mathematics. To achieve these aims, AMESA provides a forum for all involved with teaching mathematics, at all levels of education. AMESA serves as a platform for teachers to share mathematical content knowledge for teaching, and mathematics classroom management that helps improve mathematics results in their schools. In order to carry out the task of teaching, a teacher needs a more profound understanding of the common content knowledge.

A teacher should know the various definitions of concepts, be able to select relevant examples and exercises, choose the sequence for a specific topic, recognise the usefulness of particular representations over others in certain circumstances, and distinguish between correct and unproductive strategies used by learners when solving problems (Bansilal, Brijlall, & Mkhwanazi, 2014). Even if the learners are from different societies with different attitudes and beliefs towards mathematics as a subject, some of these strategies work for every classroom environment. Teachers who are members of AMESA are also able to listen to presentations from guests from all corners of this country and internationally who are invited to present their work. This provides teachers with the opportunity to choose strategies that will work for them.

AMESA encourages research related to mathematics education and brings the results of such research to the attention of its members. Researchers who are members and those who are not and have managed to gather information related to mathematics are invited to be part of these gatherings. This helps teachers who are members of AMESA to become aware of new findings related to mathematics and mathematics performance of learners in South Africa. This programme also helps to formulate policy statements on matters pertaining to mathematics education and promotes such perspectives. It actively engages in mathematics education projects that result in the social, economic, political and cultural development of society. Lastly, AMESA encourages and assists its members to strive towards a high standard of professionalism in their teaching. The 1+9 programme also incorporated some of these aims.

### **2.2.3 The Advanced Certificate in Education in Mathematics in FET**

The Advanced Certificate in Education (ACE) in Mathematics in the FET band was a formal two-year programme that educators were selected for. It comprised eight modules, two of which were nonspecific training modules that every single ACE student in the Faculty of Education studied. There were four arithmetic substance modules, which concentrated on likelihood and insights; geometry, trigonometry and estimation; differential analytics; and indispensable math. These modules were proposed to extend the educators' substance learning by including a few subjects from school science, going beyond what was required in the classroom, and could be viewed as what Ball, Thames and Phelps (2008) call “skyline information”. This pays attention to how scientific points are connected over the traverse of science incorporated into the educational modules (Ball et al., 2008). Skyline information empowers instructors to settle on choices about how to convey ideas to their school students. The programme also included two academic substance modules.

## **2.3 The impact of teachers' mathematical proficiency on mathematics performance**

A proficient teacher is defined as one who meets a number of criteria. They have mathematical knowledge for teaching, in other words, the teacher has good mathematical knowledge and various ways of presenting each topic to learners at a level that will be understandable to them so that the learners will be able to perform well in assessments. A proficient teacher should also have awareness of the background of learners and be sensitive to social variables and environmental factors. The teacher must have an understanding of the fact that learners come from different societies, with different beliefs regarding education, with particular reference to mathematics subjects, which is somehow portrayed through their performance in mathematics (Ball, 1991).

A proficient teacher must also possess the ability to interact effectively with learners; this will enable the teacher to be flexible with communication channels – for example, being able to accommodate learners when they need help with mathematics problems both inside and outside the classroom environment. Such a teacher has an ability to reflect meaningful habits of reflection towards the teaching practice, and arrives in class on time, well prepared so that the learners will engage effectively with the lesson. Proficient teachers will demonstrate understanding of teaching that is situated in a problem-solving environment, ensure that learners have more than enough activities to stimulate mathematical problem-solving skills, and provide constant feedback (Ball, Hill, & Bass, 2005).

A study conducted by Jojo, Dhlamini, Phoshoko and Ngoepe (2013) suggested that proficient teachers are able to demonstrate the following aspects of classroom instruction: mathematics knowledge, appropriate assessment techniques, and ability to handle educational and socioeconomic challenges. Further analysis of data revealed that teachers' proficiency is, however, downplayed by persistent emergence of unintended issues relating to educational and socioeconomic challenges. In turn, because the educational agenda is altered, teachers fall short in realising the full potential of their teaching proficiency ( Jojo et al., 2013).

A teacher who possesses teaching proficiency is regarded as a teacher with subject matter knowledge (SMK) – the most significant and fundamental variable in teaching mathematics (Brijlal, 2014). This is in line with the view that the quality of instruction that teachers provide for learners is largely influenced by the quality of knowledge the teachers possess, since teachers' SMK of mathematics is fundamental to their ability to provide effective mathematics teaching (Ball, Hill, & Bass, 2005; Kreber, 2002). The ineffectiveness of the mathematics teachers or their lack of teaching proficiency will always affect the results of learners' performance in mathematics negatively (Ball, Thames, & Phelps, 2008).

## **2.4 Teacher proficiency and learner attainment**

According to Makgato and Mji (2006), pedagogical content knowledge (PCK) is an important aspect in terms of the impact educators may have towards improving poor performance in mathematics. Complementing the findings of Makgato and Mji, further research emphasises the impact of didactic factors in learner achievement (Luneta, 2015; Makhubela & Luneta, 2014). The authors argue that teachers' instructional approach and their content knowledge either enhances or inhibits learners' mathematical knowledge acquisition. Ndlovu et al. (2017) allude to the fact that teachers' lack of SMK would impact negatively on learner attainment.

Heggart (2016) argues for the need to attend to teacher specialised content knowledge in order to improve learners' attainment in mathematics.

Sapire, Shalem, Wilson-Thompson and Paulsen (2016) further highlighted that the teachers' lack of engagement with learner errors during classroom teaching impacts negatively on the learners' grasp of the taught concepts. In South Africa the drive for more mathematics teacher specialists aimed to ensure that mathematics teachers have profound discipline knowledge and PCK; having both these strands of knowledge is what is deemed to be the key to learner attainment of mathematics concepts.

### **2.4.1 Proficient teachers are quality teachers: What is a quality teacher?**

According to research, a well-designed and effectively taught teacher development programme has the capacity to improve and develop teachers who are adequately prepared to teach more effectively (Onwu & Mogari, 2004). In my view, the proficient teacher must possess quality technological pedagogical mathematical content knowledge for teaching that will positively impact the mathematics performance of his or her learners. Thus, it is my view that quality mathematics teaching is a function of teachers' performance, which in turn depends on their ability and competency as well as the quality of the teacher education programme.

From the researcher's point of view, a proficient teacher is the product of the quality of the teacher development programme that has been provided to him or her. The 1+9 programme aimed at producing teachers who are of high quality and will improve the standard of mathematics in the country. There is a positive significant correlation between the mathematics development programme that the teacher has been provided with and the mathematics performance of the learners being taught.

## **2.5 Teachers' qualifications**

In South Africa we have many teachers with qualifications, but we are still struggling to produce good mathematics teachers. According to the 2011 TIMSS, the vast majority of South African teachers are now qualified; 98% of the learners tested in the TIMSS 2011 study had mathematics teachers with a post-secondary qualification, a notable increase from TIMSS 2002 (Reddy et al., 2014). In the South African context there is a shortage of mathematics teachers; hence you might find a teacher with a mathematics qualification allowing him to teach at primary school level, actually teaching at high school level. In some rural parts of the country there are teachers teaching mathematics who did not have mathematics as a major subject in his or her qualification. This impacts negatively to the performance, standard and status of mathematics in the country.

In a smaller and more recent study, Bansilal et al. (2014) investigated the subject content knowledge of mathematics teachers studying towards an ACE at UKZN. When these Grade 12 teachers were tested on a shortened version of a Grade 12 mathematics paper, the authors found that, on average, teachers obtained a score of 29% on questions at the problem-solving level.

This raised the question of how these practising teachers could mediate tasks set at high cognitive levels for their Grade 12 learners. This shows that there is a problem that needs to be dealt with, if we still have teachers who cannot solve problems, yet they are expected to mediate such problems to their learners.

The school system in South Africa also allows a certain number of heads of department (HoDs) in line with the extent of a school's enrolment; in such cases you may find an HoD that knows nothing about mathematics, because the school has a limited number of HoDs. This fact may allow a situation where a school might have an HoD who is in charge over mathematics with no mathematics content knowledge. This also becomes a factor that contributes to the learners' performance in mathematics as a subject at school. The relationship between teachers' formal qualifications and learner performance has been researched in South Africa and other developing countries. Despite the lack of research regarding the quality of teachers' mathematical qualifications versus the performance of learners in the subject, there is research which found that teacher qualifications as a measure of teacher quality were strongly associated with an increase in learner pass rates in the school-leaving examination (Zuze, Reddy, Visser, Winnaar, & Govender, 2018).

However, it should be noted that the research was undertaken at a time when some 36% of the teachers in South Africa were unqualified (had no professional teaching qualification) or underqualified (had less than a three-year tertiary qualification), so the difference between qualified and un/under-qualified teachers was stark (DoE, 2005). In addition, their study focused on the overall school pass rate, not on individual subjects such as mathematics. Research by Glewwe et al. (2001) found that when examining 55 high-quality studies, the majority showed that there is a correlation between the performance of learners in mathematics and the quality of qualification possessed by the teachers teaching mathematics. However, no

strong evidence has emerged from developing countries that higher teacher qualifications produce higher learner achievement.

Guerriero (2014) highlights many features that characterise expert teachers, which include extensive PCK, better problem-solving strategies, better adaptation for diverse learners, better decision making, better perception of classroom events, greater sensitivity to context, and greater respect for students. These are the traits that need to be re-invoked now and then in any teachers, which is why teacher development should be a continuous process. Several studies stress the importance of the knowledge that teachers hold, highlighting that in addition to assimilating academic knowledge, teachers need to incorporate knowledge derived from experiential and practical experiences in the classroom. Ball (2017) argues that the work of teaching is more advanced than the ability to solve problems – it involves one’s ability to engage with learners and develop learners’ cognitive thinking. The DoE introduced the Integrated Quality Management System (IQMS) in 2003, which was designed with the purpose of preparing an environment for teacher development, to monitor the overall effectiveness of the institution, evaluate the performance of the educator, identify specific needs of educators for support and development, and promote accountability.

Mizell (2010) states that compelling professional development empowers teachers to build up the information and aptitudes they need to address students’ learning difficulties. To be powerful with proficient advancement, teacher professional development requires smart arranging, followed by cautious usage with input to guarantee that it reacts to educators’ adapting needs. Teachers who partake in expert improvement should put their new information and aptitudes to work. Professional development is not successful unless it makes educators improve their guidance or administrators become better school leaders.

## **2.6 Mathematics anxiety and mathematics performance**

According to studies by Ansari, Maloney and Fugelsan (2011), and Suárez-Pellicioni, NúñezPeña and Colomé (2016), people with mathematics anxiety experience difficulties with

tasks that demand basic numerical and problem-solving skills. Mathematical achievement is strongly affected by ‘maths anxiety’ among young adults as well as elementary, middle, and high school students (Hembree, 1990; Ramirez, Gunderson, Levine, & Beilock, 2013). Vahedi and Farrokhi (2011) define maths anxiety as negative cognitions, avoidance behaviours, and feeling pressured and inadequate in performance; combined these interfere with solving mathematics- related problems in both general life and academic situations.

In the context of South African schools, especially those in the FET phase, when our learners have to choose between the subjects Mathematics and Mathematical Literacy, more learners choose to do Mathematical Literacy, because they perceive pure Mathematics to be a difficult subject and think that Mathematical Literacy will be easier. Some of the learners experience difficulties in mathematics and numeric problems owing to their disadvantaged background, poorly resourced schools and social environment. The DoE has also introduced Technical Mathematics, which learners also thought would be easy, only to discover that it is more complex than pure Mathematics (with the result that some learners wish to change from Technical Mathematics to pure Mathematics. All of this shows that there is a fear of mathematics in our learners, which then results in declining performance.

Ashcraft and Kirk (2001) define mathematics anxiety as a feeling of tension, apprehension, or fear that interferes with mathematics performance. These authors found that academic activities are often infused with perturbing elements, and when these are at high levels, they negatively influence the academic performance of individuals. These arousals, which are known as anxiety, are recognisable in different fields. Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. Implicit in this description is the assumption that mathematical anxiety is a causative agent of some impairment of mathematical functioning. In short, mathematics anxiety does have a negative influence, which causes a decline in mathematics performance.

## **2.7 The impact of self-efficacy in mathematics performance**

Self-efficacy refers to learners' judgement of their capability to solve Mathematics problems and perform in Mathematics-related courses. Self-efficacy refers to beliefs about one's capability to learn or perform at designated levels (Bandura, 1997). Self-efficacy involves one's judgement of one's capabilities based on mastery criteria. It involves an individual getting a sense of his or her own competence within a specific framework. Self-efficacy involves introspection regarding one's own abilities in relation to goals and standards, rather than making comparisons with others' capabilities. Most of our learners do not perform well because they lack self-efficacy. They wrongly judge themselves and think that they are incapable of doing mathematics, and that only certain people have the aptitude for doing mathematics.

According to Bandura (1997) self-efficacy forms the basis for human motivation, perseverance and behaviour. Bandura discussed the four sources of information that a learner who is doing mathematics employs to come to a conclusion about their efficacy: (i) performance experiences, (ii) vicarious experiences, (iii) verbal persuasion, and (iv) physiological and emotional reactions. These can be explained using relevant examples; for example, performance experiences are created when students have experienced success in their mathematics courses and as a result will most likely believe that they have the ability to achieve better performances in future mathematics courses. Mathematics teachers see this occurring in their classrooms, where a learner who was struggling soon gains confidence in attempting a task after he/she has passed a test successfully.

Vicarious experiences are created when learners look up to their peers who are doing well in mathematics, and would like to do well themselves. Seeing other learners doing well in class encourages some learners that they can also do well. Verbal persuasion is when a learner who was really struggling in mathematics is positively encouraged verbally by other learners, teachers or their parents. Physiological and emotional reactions are when a learner has associated negative experiences with upsetting psychosomatic symptoms, such as anxiety, pain or fatigue, when attempting to complete certain mathematics tasks.

Self-efficacy beliefs are context specific, which means that a learner may have high self-efficacy beliefs in some aspects of Mathematics, but not in others, which will result in the learner performing badly in mathematics.

## **2.8 Attitude towards mathematics learning**

According to Di Martino and Zan (2009) and Zan and Di Martino (2007), attitudes in particular are often used by teachers to explain their students' success or failure, or why they are not able to help a student. Di Martino and Zan (2009) identify three dimensions within attitudes towards mathematics: emotional disposition, vision of mathematics, and perceived competence.

McLeod (1994) notes that while attitude towards Mathematics is related to Mathematics success in the classroom, conversely, a learner's achievement can influence a learner's attitude as well.

Attitude determines somebody's 'altitude'; in most cases, our learners do not fail mathematics because they cannot do it, but because of their negative attitude towards it. Experienced teachers in class have a great role to play in changing the attitude of the learners for the better. A teacher must take their work very seriously, since the way he/ she conducts himself or herself, by doing small things that we sometimes take for granted, such as coming in very early to honour your period, giving assessment in mathematics every day after every lesson, and by being a good ambassador of mathematics, will also encourage the learners to take mathematics seriously.

## **2.9 The impact of curriculum coverage on mathematics performance**

Mathematics is depicted as numbers, sums and assessment; however, most aspects of and developments in life require the reliable use of mathematics through the use of numbers, sums and assessment. Mathematics is seen as a troublesome and hypothetical subject; its examination offers occasions for a wide scope of mental activity at a significant level, and hones learners to be able to reason wisely and completely. Since mathematics has the ultimate objective that you

can pick up capability with its rubrics through intentional philosophy, there is a set down curriculum for its teaching and learning. Curriculum, as portrayed by Adentwi (2005), is the whole assortment of courses offered by an informative association or office. It is a completed, fixed plan of courses for suggested learning at school.

The DoE introduced the ANA in 2013–2014 in the Foundation, Senior and GET bands. The ANA was planned to be a type of normalised evaluation of the Grade 9 curriculum programme, and one of the expectations was for it to provide data that could yield a plan of different mediations that could bring about upgrades in students' execution and educators' abilities. It was discovered that the ANA was not generally welcomed in schools and by educator associations (DoE, 2014). Educators demonstrated that the Grade 9 Mathematics educational programme was content-heavy for its restricted time period. Educators discovered this to be a restricting element to covering the curriculum adequately. Some educators were of the view that the Grade 9 Science Curriculum and Assessment Policy Statement (CAPS) was definitely not detailed in light of the normal student. This led to a number of students being neglected and affects negatively to the learners performance of learners in the subject.

Results of a study by Dennis, Mereku and Alhassan (2018) indicate the significant influence of teachers' content coverage on schools' performance in mathematics. The implication is that the teachers in the high-performing schools make good and effective use of the mathematics curriculum and cover a great deal of the content of the official curriculum. In other words, it was observed that schools which covered a great deal of the content of the official curriculum had better-performing students than those which failed to cover as much.

## **2.10 Conclusion**

In this chapter the researcher outlined the various education programmes that are meant to empower educators with mathematical skills and content knowledge. The researcher mentioned the VUMA programme, which helps previously disadvantaged schools to be able to teach mathematics more effectively using modern technology, such as Autograph Mathematics

Software, the Geometer's Sketchpad, etc. It also gives young and upcoming teachers experience, and helps them with content knowledge such as on the new topics like Probability and Counting Principles and Euclidean Geometry. Therefore these programmes help improve mathematics performance in learners. The researcher also mentioned various factors that contribute to the decline of results in mathematics, including the impact of teachers' mathematical proficiency on learners' mathematics performance, and the role of teachers' qualifications, where it was revealed that there are some disadvantaged schools where Mathematics is taught by teachers who are unqualified or underqualified.

## Chapter 3

### Conceptual Framework

#### 3.1 Introduction

This study adopted the conceptual framework which was developed by Shavelson, McDonnell, and Oakes (1989). It is a comprehensive model of the educational system, aiming at an indicator system that would measure the state of mathematics education. This model could help policymakers determine the nature of current problems, evaluate the factors influencing educational trends, monitor the effects of policy, and identify interventions to improve student performance. The model helps the study to identify the gaps in the education system that hinder attainment of an increase in the performance of mathematics education. Most gaps in the education system in South Africa occurred in the past, during the apartheid era.

In South Africa before 1994, learning was mainly perceived as being the transfer of knowledge from the teachers' mind to those of the learners, in the form of "teacher-tell" methods (Adler, 2010). This form of teaching was associated with the apartheid system under which the country was then ruled, where the teacher was regarded as the only source of knowledge. It was under the apartheid regime that authoritarian systems of leadership and management in classrooms appeared. This situation led to an increase in the learners' level of difficulty in understanding, as they could not challenge the teacher. Adler (2010) noted that many Mathematics educators were only one step ahead of their learners, particularly in indigent schools with predominantly black learners.

The researcher also incorporated the theory of change in the study, it is a model that can illustrate and define measurable outcomes that can be achieved after implementation process (Vogel & Stephenson 2012). Bandura's (1986) social cognitive model of reciprocal determinism, which posits that social factors (e.g., professional development projects) play an influential role in learners' cognitive development—can provide a framework for exploring whether learners benefited from teachers' instructional strategies that came as a result of the professional

development provided by the programme. The theory of change approach will enable the researcher to achieve the aims and objectives of the study using the following modes in assessing intervention of 1+9 programme: Inputs 1+9 Programme was conducted with guidelines to improve learner's performance. The educators were part of the implementation process therefore they had to be part of the 1+9 programme. The programme was implemented in the three schools that were part of the programme, and are part of the sample in this study. Outcomes: This was achieved through interviewing educators as well as learners of the teachers who were part of the 1+9 programme. Learners' written work and Report document from the department of education will also enable the researcher to achieve the outcomes. Impacts: While the researcher does the analysis of the data collected from learners' written work, interviews and Report from the Department, the impacts of the theory of change will be achieved.

In addition to this, the researcher has personally observed that some Mathematics educators had poor Mathematics results on their own Senior Certificates, some teach without qualifications, and some teach without mathematics as a merger subject. This means that they are not rich in Mathematical content knowledge. This and many other factors contribute to the poor performance in mathematics. Teaching mathematics in this 21st century has become difficult because teachers are not just providers of knowledge, they need to use different strategies and guide the students in their learning. Schools in each and every country are expected to produce learners who acquire 21st century skills that make them balanced, resilient, inquisitive, principled, informed, caring, patriotic, as well as an effective thinker, communicator, and team player.

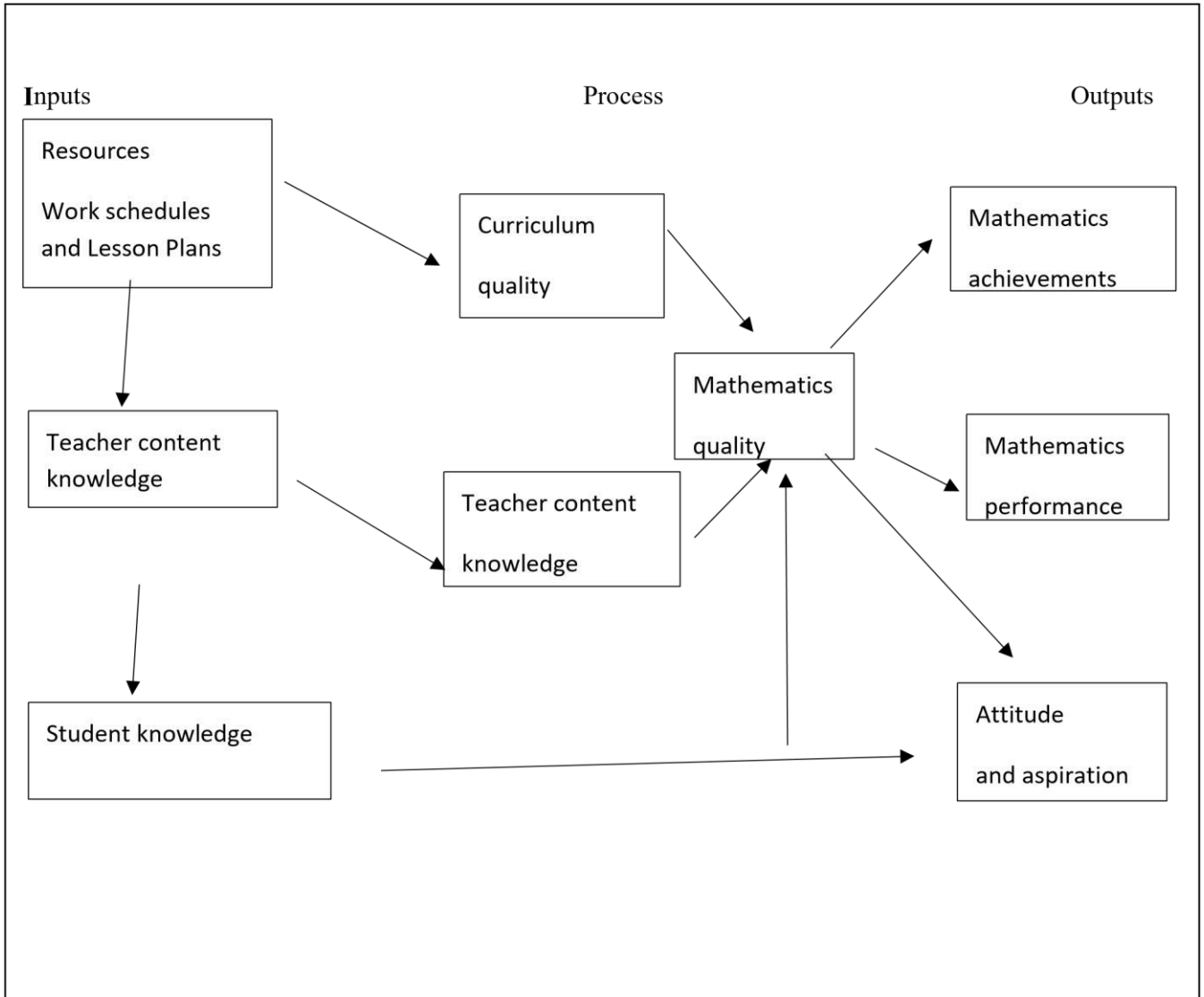
In the new structure of teaching and learning, teachers act as learning catalyst who can spark the students' ideas by directing and facilitating classroom activities. Teachers need to rethink and plan their teaching according to the redesigned curriculum. There is widespread agreement that the knowledge that teachers require for teaching Mathematics is more than sound content knowledge of mathematics itself. The learners need to have an understanding of mathematical language – not just the language for communication, but to be able to develop mathematical statements in response to mathematical equations and expressions.

Poorly laid mathematical foundations are difficult to redress in later grades, due to the mounting demands and pressures at those levels. Graven, Venkat, Westaway and Tshesane (2013) agree that “pressure to keep up with the Intermediate Phase [IP] curriculum often means it is difficult for the teachers to address the backlog of foundational understanding of learners” (p. 138). Concurring with this, Mourshed, Chijioke and Barber (2007) argue that “at the primary level, students that are placed with low-performing teachers for several years in a row suffer an educational loss which is largely irreversible” (p. 12). The National Education Evaluation and Development Unit (2012, p. 14) reports that “it is widely known that South African schools perform below expectations”.

### **3.2 Model for the conceptual framework**

The conceptual model in Figure 3.1 below is the best representation of what the researcher adopted in this study. The 1+9 programme followed such a model, and therefore the research takes us through constituents of the model. The inputs are resources such as work schedule, dated lesson plans and worksheets for learners, as well as the teacher knowledge and student knowledge. The process column consists of the curriculum quality, teacher content knowledge and mathematics quality, while the last column, the outputs, and consist of Mathematics achievements and Mathematics performance.

The conceptual framework which was developed by Shavelson, McDonnell, and Oakes (1989), features many arrows which indicate the direction of influence, as shown in Figure 3.1 (below). Looking at the arrows around mathematics achievement, mathematics performance and attitude and aspiration outcomes are directly influenced by mathematics instructional quality, together with student background knowledge. The mathematics instructional quality, in turn, is affected by the curriculum quality, teacher mathematical content knowledge for teaching, and student knowledge. The curriculum’s quality is influenced by mathematics resources such as the work schedule and proper lesson planning. The resources influence the teachers’ content knowledge for mathematics teaching and the students’ initial knowledge.



**Figure 3.1: The conceptual framework adopted by this study: A comprehensive model of the educational system (Shavelson et al., 1989).**

### 3.2.1 Inputs

#### 3.2.1.1 Resources

The researcher focused on the 1+9 teacher development programme with the aim to ascertain the impact it had on the performance of mathematics by learners. The teachers were given the

work schedule with the pace-setters, which were meant to ensure that teaching and learning is at the same pace. Teachers were also given a task resource book, which works as a question bank from which the teachers extract the tasks to be given to learners. With this programme on board, teachers were forced to teach to cover and complete the whole Annual Teaching Plan for Grade 9. It is a well-known fact that some teachers who teach in the GET phase don't finish the work prescribed for the year. There is evidence that there is little or no proper monitoring in the GET phase, and teachers only teach what they will set for the assessments, because the assessments in the GET phase are not common (Makhubela & Luneta, 2014).

### **3.2.1.2 Lesson planning**

Teachers were given lesson plans as part of the resources in these workshops, so that they would go and use them in their classroom. Lesson planning is an important task of teaching, with six main important points. They assist teachers to:

Ensure alignment across grades. Lesson planning should be done across grades to avoid omissions and unnecessary repetition. It gives a teacher clear guidance of where and what to do and when.

Avoid teaching from cover to cover. A lesson plan is important as it gives a sense of direction in relation to standards. It is more important for the students to learn deeply with understanding, than to skim through many topics superficially.

How to teach. While being clear about what topics to teach is important, knowing how to teach them is the key to success in the classroom. The same topic can (and should) be taught differently, depending on the students' skills, temperament and attitude. These considerations should influence a teacher's planning of the tasks to be presented, resources needed and pacing of the lessons. With the students in mind, the teacher should ask questions like 'Should we spend more time on concrete manipulatives?'

A good lesson plan makes for a confident teacher. Many teachers teach in the same way they were taught as students. However, that might not be the best way. We need to

constantly update ourselves with best practices that work and allow one to teach more effectively. For example, a teacher who has only learned ‘how to’ and not ‘why’ when growing up will need to evaluate their own gap in knowledge when drawing out the lesson plans for the semester. This gives the teacher confidence when delivering the lesson in the classroom. A confident teacher inspires respect from students, which in turn reduces problems with discipline.

Lesson planning now saves time in future. Lesson plans serve as a useful basis for future planning. They can be used again, in part or in whole, for future classes. Lesson planning for subsequent years can be drawn and modified from current planning. The extra effort put in by first-year teachers to plan and organise the entire year’s lesson plans and resources will go a long way for subsequent years’ teaching the same level.

Handing over and professional performance. A clear lesson plan can be used by substitute teachers, ensuring that time is used productively. It can also serve as a central document for handing over to new teachers who are teaching the level for the first time. In addition, lesson plans, along with other materials, can also be used to support annual performance evaluation. Teachers applying for a new job can also submit samples of their lesson plans, to show their content understanding and organisational skills. There are many important benefits of having a clear and organised set of lesson plans. Good planning allows for more effective teaching and learning. However, many things can happen in class, and it is important for teachers to adapt their plans to respond to the students’ needs.

### **3.2.2 Teachers’ knowledge**

To begin with, what does it take to be capable at mathematics instruction? In the event that the students are to be instilled with mathematical capability, teachers must have a form of a proper guide with the objectives of guidance and what capability implies for the particular mathematical topic they are instructing (Denessen, E, Abramovich, S, Grinshpan, A, Z & Milligan, L.(2019) . They have to know the mathematics they teach just as well as the ‘skylines’

of where that mathematics can lead and where their students are going with it. They should have the option to utilise their insight deftly to evaluate and adjust instructional materials, to speak to the substance in a legitimate and open manner, plan and direct guidance, and survey what learners are realising. Teachers should have the option to hear and see articulations of student mathematical instruction thoughts and to plan. There is no doubt that most teachers who are teaching mathematics are especially qualified to teach. This means that there is sufficient mathematical knowledge for teaching – but we still see the rate of mathematics performance declining. Teacher content knowledge at an input phase is the knowledge that they possess at the beginning of the workshop.

### **3.2.3 Students' knowledge**

Information on students and how they learn mathematics incorporates general information on how different mathematical thoughts are created in children after some time, just as explicit information on the best way to figure out where in a formative direction a child may be situated. It incorporates recognition of the normal challenges that learners have with certain numerical ideas and techniques, and it envelops information about learning and about the sorts of encounters, plans, and approaches that impact students' reasoning and learning. Learner knowledge at an input stage is determined by looking at the mathematics performance of learners that were taught by the same teacher before he/she was part of the programme.

## **3.3 The process**

In the process category there is 'Curriculum quality' and 'Teacher content knowledge' that ensure the quality of mathematics.

### **3.3.1 Curriculum quality**

#### **3.3.1.1 What are the characteristics of a quality curriculum?**

The most important factor in the success of a child is the teacher in the classroom. The second most important factor is the curriculum that is in place.

The curriculum should foster growth of the development of attitude and skills required for maintaining a planned social order of democratic type. To put it more concretely, it should contribute towards democratic living in a nation. It should not be narrowly conceived but dynamic and forward-looking, and sample adequately both the scientific content and the abilities of the pupils to be developed. It should cater to the right use of leisure later on, and should be related to the environment in which the children live. Consequently, it will then become exciting, real and imaginative.

### **3.3.2 Ten characteristics of a good curriculum**

As Rahmah (2018) outlines, the following are ten characteristics of a good curriculum:

1. At the heart of a high-quality curriculum is the premise that all students are able to learn and are capable of being successful. In effect, a standard curriculum is built on high expectations and should be rigorous to undertake.
2. Because the curriculum prepares learners for life in the society, a curriculum obviously should be dynamic and evolve regularly to meet the needs of learners as well as the society.
3. A curriculum should gradually build the learning experience. This means that it should allow for continuity of experiences as the learner progresses and grows.
4. Every curriculum should meet the needs of individual learners – whether it's for private or public schools, every student's needs should be considered while choosing a curriculum.
5. Because it caters to a wide variety of people, a good curriculum should be developed democratically. This means educators representing all grade levels and disciplines should be included in order to achieve cohesiveness that targets the success of every child.
6. Every aspect of the curriculum should have a clear objective or end goal to achieve.

7. A good curriculum is not rigid – it allows room for flexibility, monitoring and evaluation by administration.
8. It should provide sufficient scope for the cultivation of unique skills, interests, attitudes and appreciations.
9. It should be psychologically sound. It should take into account the theories of learning relevant to the fields of study. As such, a broad range of possible learning styles must also be considered.
10. Lastly, a curriculum should be responsible for personality development of the learners.

A grade 9 mathematics curriculum with the above mentioned characteristics of a good curriculum will be helpful in the classroom for a teacher to execute his/her duties easily. It will also assist in ensuring that the learner is fully developed in becoming a better learner capable of doing better in mathematics. It will also help in encouraging learners to do well and to love mathematics as a subject.

In the South African context, the curriculum is centralised, which makes it accessible, controllable and manageable. It is argued that there is so much fragmentation and conflicting influences on the school curriculum that a centralised approach is needed.

### **3.3.3 Advantages of centrally based curriculum development**

An advantage of centrally based curriculum development is that it provides a uniform delivery system which promotes uniformity, encourages standardisation of curricula, and enhances equality in education and distribution of scarce resources (Marsh, 2018). Centrally based curriculum development also saves time by avoiding detailed analysis of the needs of individual schools, while being efficient and easy to manage. In this way, it saves both time and energy. It ensures continuity because policies can be measured over a number of years. Students and parents can be assured that policies will be the same, even if students move schools (Marsh, 2018).

Centrally based curriculum development concentrates expertise, by enabling teams of experts to be used and sufficient funds to be provided to produce quality materials.

Through providing high-quality materials, up-to-date subject matter is included and technologically advanced techniques are used.

Such a system provides a tighter coupling between the school and the system, whereby the central office can control activities in individual schools, and require schools to reach certain goals.

### **3.3.4 Teacher content knowledge**

The Pedagogical Content Knowledge (PCK) is important to the educators and teachers for classroom instruction. This is what teachers need in order to help their student to reach their goals. In the process of this research study, the programme afforded teachers time to share skills on how they can they help learners to do better in mathematics. The challenges may differ in each and every school, but the content delivery will always be the same. The common goal is to ensure that learners are getting that which will help them to learn as much as they can in mathematics. The most common challenges that seem to be present in the disadvantaged schools is lack of resources, and learners that perceive mathematics as a difficult subject. However, the biggest challenge that faces our teachers in the mathematics classroom is the lack of interest from learners to learn. Learners don't understand the importance of learning mathematics. Teachers spend most of the time trying to share ideas on their approach to teaching the learners in their classrooms. Teachers also shared how to develop both formal and informal assessments.

### **3.3.5 Quality mathematics instruction**

The researcher has used all of the inputs and components in the process for ensuring quality mathematics instruction. This trend will be determined by improved learners' content

knowledge, the quality of the resources provided in the classroom, improvement in the delivery of the curriculum, and the quality of the teachers' content knowledge.

### **3.4 The outputs**

In this phase the researcher looked at the three aspects of the achievements of the programme: The mathematics performance, and the attitude of the both teachers and learners.

#### **3.4.1 Mathematics achievements**

There are many building blocks for good achievement in mathematics. From the process phase there is evidence that mathematics quality contributes to mathematics achievement. The teachers' content knowledge also plays a very significant role in ensuring that student achievements in mathematics are high. A number of studies have ascertained the important factors that contribute to mathematics achievement, described below.

##### **3.4.1.1 Patience towards problem solving and mathematics achievement**

A study conducted by Faridah (2004) found that students with high levels of perseverance will not stop trying to learn the subject until they manage to get the answer, and will continue to work on a problem until they succeed in solving it. Her study reported that most students immediately make an attempt to work out the problem, without first planning any strategies to do so, which results in only a moderate number of students able to solve the mathematical questions. Her study also indicates that students lack the patience to carefully read and understand the questions given. Therefore, her findings indicate that patience towards problem solving is essential to achieve good results in mathematics. Most learners aren't able to solve the problem because they do not want to continue trying. In the 1+9 programme the teachers shared ways in which they can inculcate a culture of reading into their learners.

### **3.4.1.2 Confidence towards problem solving and mathematics achievement**

According to Beckner (2008), students' commitment in mathematics refers to their own motivation to learn mathematics, their confidence in their ability to succeed in mathematics, and their emotional feelings about mathematics. Students' commitment in mathematics plays a key role in the acquisition of math skills and knowledge (Buckner, 2008). Therefore, confidence towards problem solving is believed to play a significant role in mathematics achievement, and might be one of the factors that influence students regarding mathematics achievement (Mohd, Mahmood, & Ismail, 2011). The process of learning in the mathematics classroom needs to be learner-centred – the teacher's role is only to guide. The teachers that were part of the programme also shared ways to involve learners in their teaching, because when learners are more involved in the task then the confidence is high, which will result in good achievement.

### **3.4.2 Mathematics performance**

Teachers play an important role in the realisation of the high standards which are increasingly emphasised in schools and school systems across the world (Enu, Agyman, & Nkum, 2015). Despite the general agreement about the importance of high-quality teachers, researchers, practitioners, policy makers and the public have been unable to reach a consensus about what specific qualities and characteristics makes a good teacher and performance.

The profession of teaching is becoming more and more complex and the demands placed upon teachers are increasing in an ever-changing world (Enu et al., 2015). Being a teacher with PCK(Pedagogical Content Knowledge) does not mean your learners are good too. There are many factors that influence the performance of mathematics by learners: the quality of the school, socio- economic factors, the quality of curriculum delivery, the teacher PCK, attitude of the learners, and learners' background content knowledge of mathematics.

### **3.4.3 Attitude and aspirations**

Teachers' beliefs and attitude about teaching and learning can influence their teaching practices. Stipek, Givvin, Salmon, and MacGyvers (2001) found substantial coherence between the teachers' beliefs and their classroom practices. Teachers who held traditional beliefs about mathematics emphasised performance and speed in their classrooms, rather than learning and understanding. These teachers also gave students less autonomy and created a classroom environment where mistakes were viewed as something to be avoided, rather than creating an environment where there was no risk of being embarrassed if a mistake was made (Tuimavana & Datt, 2017).

The beliefs that teachers hold can also affect their students' beliefs. The teacher needs to play a vital role in selling his subject to the learners. Hurtado and Carter (1997) highlighted the similarities of the belief of student teachers, which is in congruence with that of their teacher educators (Tuimavana & Datt, 2017). The 1+9 programme developed a positive attitude towards teaching mathematics subject. The attitude of the teacher starts with preparation for the lesson. If the teacher is dragging himself, for example, is always late and absent most of the time, then it is likely that learners are not doing well in his subject. If he/she is always well prepared and their attitude towards teaching mathematics is positive, then learners will also like the subject and do well in it.

Mathematics teachers should believe that different approaches can exist in problem solving, and later should give worth to the students performing such approaches; however, the opposite is the reality. The relationships among mathematical concepts cannot be established correctly and there are difficulties in problem-solving skills or in relating to a mathematical concept. Since such difficulties prevent an individual's mathematical thinking from improving, they decrease the chance of success.

In educating a mathematics teacher, the teacher's contribution to learning in the classroom and her behaviours can be more positive if acquaintance with mathematical power and thinking are taken to be of primary importance. A proper environment for discussion can be formed among learners, and the knowledge is transferred from one learner to the next. As a result, the class

can be a more attractive place, and some contributions to improving attitudes towards mathematics can be achieved in a positive way. Learners' beliefs about their competence and expectations of their 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 (Enu, Agyman, & Nkum, 2015).

### **3.5 Conclusion**

In most studies on the academic performance of students, it is not surprising that socio-economic status is one of the major factors considered while predicting academic performance (Enu et al., 2015). While resources, curriculum quality, teacher content knowledge and attitude and aspiration play their roles in influencing the performance of learners in mathematics, the aspect of socio-economic status plays a vital role in mathematics performance. Social ills within communities have a negative impact on education in any country.

According to Aysun Nüket Elçi (2017) there is a correlation between mathematics and attitude, and there have been some investigations assessing the relationship between attitudes towards mathematics and the approaches of teachers. Students adopt many of the attitudes of their teachers, because they use them as models. The teacher with a negative attitude towards his/her subject negatively influences students' performance in his/her subject.

The model discussed in this chapter helps to indicate that the performance of learners is a combination of many building blocks. Each of these blocks and how they affect the other blocks were discussed. The main purpose is to improve the performance of mathematics in learners.

## **Chapter 4**

### **Research Methodology**

#### **4.1 Introduction**

The main purpose of the study is to explore the performance of Grade 9 learners in mathematics after implementation of the 1+9 programme. The programme started as 1+4, where teachers in clusters planned together how to teach a particular topic to be covered within a week, following the curriculum. It was later changed to 1+9, where a teacher teaches for 9 days and meets with other teachers in his/her cluster for planning on one day every two weeks.

However, since the inception of the 1+9 programme not much has been done to explore learners' performance, since its ultimate goal was to enhance teacher performance through helping teachers with methodologies to teach. The programme was run in other districts of KZN, such as Amajuba and King Cetshwayo, and a slight improvement was witnessed (Matlali, 2018), and hence it was taken to other districts such as uMmgungundlovu. However, in uMgungundlovu District there has been no evidence or study to explore impact on learner performance since the inception of the 1+9 programme.

In the previous chapter the researcher presented the theoretical framework underpinning this study. This chapter therefore presents a comprehensive discussion of the methodological design of this study. The first section provides a description of the study setting, followed by the research questions. In order to provide a comprehensive picture of the methodology design, the subsequent section discusses the paradigm, design and research style deemed suitable for this study. Furthermore, sampling and sampling procedure are discussed, followed by methods of data collection and data analysis. In order for the findings to be trustworthy, certain measures need to be taken care of during the data collection process, and therefore issues of trustworthiness and credibility considered for this study are elaborated on. In empirical research

ethical considerations are critical, and the researcher describes strategies employed to ensure that ethical issues were taken care of. The chapter ends by discussing the limitations of the study.

## **4.2 Study setting**

The study was conducted in three schools in the Province of KZN in South Africa. The focus was the uMgungundlovu District in Vulindlela Circuit, which is the combination of the Elandskop, Sweetwaters, Impendle and Mpofana Circuits. The three schools were part of the 1+9 programme in the years 2015 and 2016, and therefore teachers at these schools participated in the programme. For ethical purposes of confidentiality, the schools are named school A, school B and school C. Two of the schools (namely schools A and C) belong to the Sweetwaters Circuit, while school B is part of the Elandskop Circuit.

The Grade 9 mathematics teachers in these three schools all attended the 1+9 programme at Vulindlela Education Centre, every fortnight from the beginning of 2015. In the uMgungundlovu District, schools that are from rural areas and locations have been considered as performing poorly in mathematics over the years due to poor school infrastructure and a shortage of human resources, including qualified mathematics teachers. However, in these three schools those who participated in the 1+9 programme are qualified mathematics teachers and have been teaching in these schools since the inception of that programme.

The majority of learners in these schools are from a low socio-economic background. They either come from child-headed families or are raised by guardians, single parents or grandparents. School A has a population of about 550 learners with 18 teachers including 3 mathematics teachers, 3 HoDs, 1 Deputy Principal and a Principal; school B has a population of about 650 learners with 24 teachers including 2 mathematics teachers, 4 HoDs, 1 Deputy Principal and a Principal; while school C is a very large school with 1724 learners with 39 teachers, including 5 mathematics teachers; 4 HoDs, 2 Deputy Principals and a Principal.

The three schools that are part of this study are from quintiles 1–3 (no fee-paying schools) in terms of the Department of Basic Education’s categorisation. The no fee schools rely on the government for everything they need. In contrast, the fee-paying schools do not receive enough support from government, but are able to do most things for themselves, for example, ordering additional materials to help learners and hiring additional teachers to ensure that they meet the learner: teacher ratio of 1: 30, which helps enhance the quality of teaching and learning.

### **4.3 Critical research questions**

In order to unpack the aim of this study, which is to explore Grade 9 learner performance after the presentation of the 1+9 programme, the researcher set out to answer the following research questions:

- How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level?
- What do Grade 9 learners’ written responses reveal about their competency in mathematics after implementation of the 1+9 programme?

### **4.4 Research paradigm**

This study adopted an interpretivist paradigm. According to Creswell (2014) interpretivist researchers discover reality through participants’ views and their own background and experience. Within the interpretive paradigm researchers do not aim to predict what people will do, but rather aim to describe and understand how people make sense of their worlds and how they make meaning of their particular actions (Bertram & Christiansen, 2014). Interpretivists adapt a relativist ontology in which a single phenomenon may have multiple interpretations, rather than a truth that can be determined by a process of measurement (Riyami, 2015). With the interpretivism perspective researchers tend to gain a deeper understanding of the phenomenon and its complexity in its unique context, instead of trying to generalise the base of understanding to the whole population (Creswell, 2014).

In the same way, Hammersley (2013) emphasises that since multiple interpretations are developed among humans' relationships, interpretivist researchers should try to understand "the diverse ways of seeing and experiencing the world through different contexts and cultures", and try to avoid the bias in studying events and people through their own interpretations. In this aspect, some advantages of this paradigm may be highlighted. The first advantage is that with the diverse viewpoints from which to look into phenomena, interpretivist researchers can not only describe objects, human or events, but also deeply understand them in their social context. Second, interpretivism allow for leveraging the key method of interactive interview, which "allows researcher to investigate and prompt things that we cannot observe, researchers can probe an interviewee's thoughts, values, prejudices, perceptions, views, feelings and perspectives" (Wellington & Szczerbinski, 2007).

According to Yin (2014), the search for meaning is a search for concepts, a collection of which can be used to represent a theory about the experiences that have been learned. The interpretivist paradigm allows the researcher to view the world through the perceptions and experiences of participants. In this study the researcher conducted interviews to obtain information on the experiences of the participants, and could use them to make sense of the environment that the participants found themselves in. In seeking answers, researchers who work in the interpretivist paradigm use those experience to construct and interpret understanding from gathered data.

Cohen et al. (2011) state that during interpretivist studies concepts have to be grounded in records that are generated, and interpretivist researchers work directly with, revel in and know how to construct their principles. This means that interpretivist researchers are more involved with how individuals make meaning and interpret the fact of their contexts. Angen (2000) claimed that 'interpretivist 'assumes that researchers' values are inherent in all stages of the interview, and that the fact is negotiated right through the interview technique. Angen (2000) outlined the following traits of the interpretivist paradigm: (1) interpretivist methods rely closely on naturalistic methods (interviewing, observations and analysis of present texts); (2)

these strategies make sure there is a good enough communication among the researchers and people with whom they have interaction to construct a significant reality; (3) generally, meanings are emergent from the research system; and (4) qualitative methods are used. Cohen et al. (2011) state that interpretivist research interprets and discovers the perspectives of the participants within their environment and solutions to the research are structured within the context. Therefore, this study falls within the interpretivist paradigm.

#### **4.4.1 Suitability of the interpretive paradigm for this study**

A research paradigm guides the process of inquiry and forms the basis for the practice of science, by directing the research towards appropriate research methods and methodologies, depending on the nature of the phenomenon being studied (Henning, Van Rensburg, & Smit, 2004). This study was located within the interpretive paradigm, which requires going into the participants' natural setting and experiencing the environment in which they create and recreate their reality (Radnor, 2002). It is within these parameters that the interpretive paradigm was deemed suitable for this study, since the researcher aimed to gain an in-depth understanding of the performances of learners taught by teachers who participated in the 1+9 programme. This would be achieved by going directly to their natural settings to review documents and conduct interviews, enabling the researcher to interpret the data through the eyes of the participants. The interpretive paradigm is based on the belief that it is not only by observation that knowledge is constructed, but also by explanations of people's intentions, beliefs, values, reasons, meaning-making and self-understanding (Henning et al., 2004). The paradigm resonated well with this study, as the researchers' intention was to find meaning within social interactions. Informed by this thinking, the researcher viewed participants not as objects to be studied, but rather as interpreters and creators of knowledge as constructed in their context. As such, the study utilised qualitative data collection methods that included interviews and document analysis.

## **4.5 Research approach**

The design deemed suitable for this study is qualitative in nature. Qualitative research involves a multi-method focus, involving an interpretative, naturalistic approach to its subject matter. This means that qualitative researchers observe matters in their natural settings, trying to make sense of, or interpret, phenomena in terms of the meanings people give to them. Qualitative studies include the use and collection of a selection of empirical substances – case study, personal experiences, introspective, life story, interview, observational, history, interactional, and visual texts – that describe recurring and complicated moments and meanings in people's lives (Denzin & Lincoln, 2005). According to Creswell (2014) researchers using qualitative approaches tend to pay attention to participants' views when doing their studies, ask general, open-ended questions and collect data in natural settings as the study develops.

Various researchers believe that the interpretivist paradigm predominantly uses qualitative methods (Glesne & Peshkin, 1992; Silverman, 2005; Thomas, 2003; Marsh & Willis, 2007; Nind & Todd, 2011). Marsh and Willis (2007) assert that interpretivists tend to favour a qualitative approach, because they often provide the rich reports that are necessary to fully understand contexts.

Qualitative research is a rigorous approach of finding answers to questions and involves spending an extensive amount of time in the field, working on the often complex, time-consuming process of data analysis, writing long passages, and participating in a form of social and human science research that does not have firm guidelines or specific procedures (Soiferman, 2010).

### **4.5.1 Suitability of qualitative approach for this study**

Qualitative research is an umbrella term covering several forms of inquiry that help us understand and explain the meaning of social phenomena with as little disruption to the natural setting as possible (Cohen, Manion, & Morrison, 2018). As mentioned above, qualitative

researchers are interested in understanding the meaning people have constructed. It is assumed that meaning is mediated and interpreted through the eyes of the participants. A qualitative design was deemed appropriate for this study because it allowed the researcher to understand how the teachers who participated in the 1+9 programme influence the performance of learners after their participation in the programme. The researcher therefore deemed it necessary to use more than one method of data collection in order to explore the phenomena from different perspectives, these methods being document analysis and semi-structured interviews.

In all forms of qualitative research the researcher is the primary instrument for data collection and analysis. Another characteristic of qualitative research is that it usually involves fieldwork; researchers must go to the people, setting, site, institution, in order to observe behaviour in its natural setting. In this study the researcher went to collect data in the schools where the participants teach, with the aim of capturing participants' responses in their own settings. The researcher was able to experience each environment and how it was interpreted by each participant. As purported by Soiferman (2010), the researcher deemed it necessary to spend time in the schools where the participants teach, because it is through interacting with participants in their natural setting that appropriate answers to the research questions would be found and respond to the phenomena being studied.

Another component of qualitative research is that it uses an inductive research strategy. Inductive research “involves the search for pattern from observation and the development of explanations – theories – for those patterns through series of hypotheses” (Soiferman, 2010). In inductive studies no theories or hypotheses would apply at the beginning of the research, and the researcher is free in terms of altering the direction of the study after the research process has commenced. This approach aims to generate meanings from the data set collected in order to identify patterns and relationships to build a theory; however, the inductive approach does not prevent the researcher from using existing theory to formulate the research question to be explored. While this study does not draw from any hypotheses, it uses different theories to form a coherent conceptual framework in order to understand the phenomena being studied. The

research set out to understand and interpret patterns that emerge, which resonates with an inductive research strategy. Inductive reasoning is based on learning from experience. Patterns, resemblances and regularities in experience are observed in order to reach conclusions or generate theory (Bernard, 2011; Saunders, Lewis, & Thornhill, 2012; Neuman, 2003). The researcher set out to learn from participants' experiences, which inform their practices and learners' performances. In addition, drawing from the participants' understanding of the inquiry, the researcher observed the patterns that emerged, in order to form coherent themes and answer the research questions.

#### **4.6 Research Design**

The research style adopted for this study is the case study. According to Sturman (1997, p. 62) "A case study is a general term for the exploration of an individual, group or phenomenon". A case study is a comprehensive description of an individual case and its analysis that is, the characterisation of the case and the events, together with a description of the discovery process or the process of research itself (Mesec, 1998). According to Mesec (1998), a case study "is a description and analysis of an individual matter or case with the purpose to identify variables, structures, forms and orders of interaction between the participants in the situation (theoretical purpose), or, in order to assess the performance of work or progress in development (practical purpose)" (p. 383). He adds that one case study could serve both purposes at the same time.

In this study the researcher focused on schools where teachers were part of the 1+9 programme and the purposively selected three schools (A, B, and C). The case in this study included both the teachers who participated in the 1+9 programme as well as the schools, because the context plays a crucial role for a teacher to implement activities learnt in the programme. Implementation of the 1+9 programme would require support from all of the relevant structures, and thus it was important that both the schools and teachers who participated in the programme became the units of analysis in this study. The researcher aims to provide a rich and thick description of learner performance in mathematics post the 1+9 programme, in schools that

participated in the programme and taught by teachers who participated in the programme. As is described by Cohen et al. (2011), the researcher aims to capture the reality of the participants' lived experiences or thoughts about a particular situation. The participants in this research, both teachers and learners, are interviewed to determine their insights and feelings about mathematics performance and the 1+9 programme.

#### **4.6.1 Suitability of case study research for this study**

Case studies aim to describe what it is like to be in a particular situation, so they are generally descriptive in nature; however, they can also be used to generate claims for further verification. The researcher aims to capture the reality of the participants' lived experiences or thoughts about a particular situation (Cohen, Manion & Morrison, 2011). The researcher in this study adopted a case study design of research because it allowed him to be more flexible in using different data collection techniques, including in-depth interviews with learners and teachers and review of documentation in the form of learners' mark schedules. The case study also suits using various data collection techniques and applying triangulation to minimise the weaknesses around continuity of each technique while at the same time increasing the rigor and validity of the data (Yin, 2014).

#### **4.7 Sampling and sampling procedure**

Purposive sampling was used to select the schools for this study. Since the study focuses on Grade 9 learner performance post 1+9 implementation, there were three Grade 9 mathematics teachers, who were recruited to participate in the study from the three chosen schools. The three teachers had to undergo on a one on one interview with the researcher. In the same schools the researchers also selected three learners from school A, four learners from school B and three learners from school C, these learners are currently taught by the teachers who went for the 1+9 programme. They are a total of ten learners who were interviewed in this study. As purported by Bertram and Christiansen (2014), in purposive sampling the researcher makes specific choices about which people, groups or objects to include in the sample. In this study, the researcher made a specific choice to include Grade 9 mathematics teachers who have

participated in the 1+9 programme, because they are those who can provide rich data about the phenomena being studied.

Since the study also focuses on learner performance, the researcher randomly selected forty two learners' marks from the mark schedule which were compiled by the teachers in the year 2016, 2017 and 2018. The marks of these 42 learners will be displayed in chapter 5, table 5.1, table 5.2 and table 5.3. The Analysing their performance provided an in-depth description of the effect of the programme on learner performance. The 1+9 programme focused on mathematics teachers in the senior phase. The learners were selected on the basis that they attended schools that participated in the 1+9 programme and were currently being taught by teachers who had participated in the programme.

As mentioned by Cohen et al. (2011), the selection may suit the researcher's needs but not represent the wider population, which "is deliberate and unashamedly selective and biased" (p. 104). In this study, the selected participants suit the purpose of the study. Participants were selected using the following criteria: (1) they are teachers who were part of the 1+9 programme; and (2) they are learners currently taught by teachers who attended the 1+9 programme.

#### **4.8 Data collection methods**

Data collection took place in three phases. The first phase was document review or analysis, looking at learners' results in previous years and the results of those learners currently completing Grade 9. Analysing the results for the past three years (2016, 2017 and 2018), the aim was to see how the learners performed while the teachers were still involved in the 1+9 programme and how this changed after the teachers' involvement in the programme. Learners' results from the years 2016, 2017 and 2018 for each of the schools were analysed. The second phase involved conducting interviews with learners currently in Grade 9. The third phase involved conducting interviews with Grade 9 mathematics teachers, to understand from their perspective the impact of the 1+9 programme on improvement of learner performance in mathematics.

#### **4.8.1 Document review**

Document review was adopted as one of the research methods to improve the accuracy of the study, as it allowed the researcher to review the results of learners' performance during and after the 1+9 programme (Silva & Mosimane, 2013). Document analysis is a way of collecting data by reviewing existing documents, which may be internal or external to the programme or organisation. In this study, internal documents from each school were analysed. Documents may be in the form of hard copy or electronic, and may include reports, programme logs, performance ratings, funding proposals, meeting minutes, newsletters, and marketing materials. For the purpose of this study, documents took the form of hard copies of learners' marks schedules.

Document review is different from a literature review, and touches mostly on data and information specific to the organisation under study (Nyambe, 2005). In this study, the researcher used the mark sheets from Grade 9 mathematics learners for 2016, 2017 and 2018 provided by schools A, B and C. In terms of presentation of the data, tables (Tables 5.1, 5.2 and 5.3) were used by the researcher to present the grades obtained by learners in a particular year, in all cases giving the learners pseudonyms. The study is a qualitative study however, learners marks were used to compare learners performance from the year 2016, 2017 and 2018 this is in the figure 5.1. Permission was granted to the researcher to use the mark sheets for these years to gather information for the study. In this study the focus was not on individual learner performance, rather it was on exploring the performance of learners as a whole who were taught by teachers who have undergone a professional development programme. For the learners currently doing Grade 9, the focus on individual performance was purely for selecting learners to participate in the interviews. The researcher hoped that interviewing learners whose performances are at different levels would provide a broader understanding of how the programme has helped teachers to enhance learner performance.

The advantages of this method are that it is relatively inexpensive, while being a good source of background information, is unobtrusive, provides a behind-the-scenes look at a programme

that may not be directly observable, and may also bring up issues not noted by other means (e.g. the issue of gaps between the marks of learners). Disadvantages of this method are that it could be biased because of selective survival of information, information may be incomplete or inaccurate, and it is time-consuming to collect, review, and analyse large numbers of documents.

#### **4.8.2 Semi-structured interviews**

In a case study, semi-structured interviews are the primary source of information (Silva & Mosimane, 2013). In this study, there were gaps of about 5 minutes between sessions with participants. The researcher later listened to, translated, wrote up and analysed each recording to find out which direction it would follow (Saunders, Lewis & Thornhill, 2016). An interview is an important qualitative research method where the researcher collects data directly from the participants (Showkat, 2017). The researcher prepared questions for the teachers and learners, specifically relating to the 1+9 programme. There is no fixed sequence to be followed in this type of interview (Showkat, 2017). Semi-structured interviews are mostly of substantial duration and conducted face-to-face to achieve desired goals. These semi-structured interviews, also known as one-on-one interviews, are a method of extracting more detailed information to obtain a deep understanding of a subject or concept (Showkat, 2017).

In this study the interviews ranged from 15 to 20 minutes per session and were conducted individually with each participant. The question guide contained some open-ended questions, which allowed the conversation to be flexible for both the researcher and the informants. Through open-ended questions the researcher was able to seek clarification from the informants where necessary. Each interview session was audio recorded using a cell phone device, and field notes were used to capture non-verbal communication, including facial expressions and the manner in which questions were answered. The audio recordings and field notes were used to present findings, discuss the results and for data analysis. The researcher was consistent in terms of using the question guide.

### **4.8.3 Suitability of data collection methods for this study**

This study is qualitative and is informed by an interpretivist paradigm, so the utilisation of interviews as an instrument to gather information was central. The interpretivist paradigm advises that people are not just manipulable subjects from whom information can be collected; rather, information is created between two people through discussion (Cohen et al., 2007). These authors further contend that the interview might be somewhat controlled, while allowing space for the interviewer to press for complete answers where applicable, and reactions which are unpredictable and more profound issues may emerge. Consequently, face-to-face interviews were the best instrument for gathering information in this study. As per Cohen (2006), interviews empower members to talk about and decipher the world in which they reside and how they see circumstances from their own perspective. As put by Bertram (2004), interviews are an examination apparatus that can be utilised for discovering information on the issue being talked about. Semi-structured interviews were chosen for this study in order to gain in-depth knowledge about learners' mathematics performance after teachers had participated in the 1+9 mathematics intervention programme. Semi-structured interviews are adaptable and permit the interviewer to probe for more significant information where appropriate (Ndlovu, 2012; Kremer, 2005). In this study, field notes served to capture reactions which the verbal responses alone could not. It was absolutely critical that the interviews aimed to get informative reactions to the inquiries presented. Ndlovu (2012) states that the fact that the interviewer can observe non-verbal conduct of the part of participants in the face-to-face interviews is one of the advantages of this method.

Nonetheless, there may be a few impediments to these interviews, one example being time restrictions. Interviews are protracted and may require additional time, which is testing when one needs to obtain an interview with instructors whose schedules are tight. Another issue is that the participant may choose to react in a way that they think the questioner expects, rather than really communicating how they feel; this represents a factor of biasedness. In an effort to address the above challenges, in this study participants were given the interview schedules to peruse prior to the interviews.

## **4.9 Data analysis**

This is a qualitative study, as explained in the research design. However, numerical values were used to present the analysis of learner performance. While this might be considered to have some aspect of quantitative research, the way in which it was used does not qualify it as a quantitative design, and the study is deemed to be qualitative.

Data analysis was in two phases. The first phase involved averaging learner performance from 2016 to 2017, with the average mark recorded and verified against learners' marks on the mark sheets for the two years. In 2018, learners' marks recorded on the mark sheet for each term were recorded and totalled to get an average mark for each learner. This analysis allowed for the categorisation of learners' performance and comparison of performance in the participating schools over the three years. The data from the interviews was analysed inductively to identify themes. This process began by transcribing data from both teachers and learners, followed by manual coding of responses. Saldaña (2015) describes coding as a process in which a researcher assigns a word, phrase or code to represent key ideas, summaries, or the essence of a set of data that has been collected. The purpose of using codes is to eventually find patterns where pieces of data have some sort of relationship between them.

In this study, codes were generated by first reading through the data and looking at what ideas and thoughts were regularly emerging. These common ideas were assigned a code in the form of a phrase and could be abbreviated. Codes were generated manually and were written down and later tabulated against the various data extracts. Codes which were similar in nature were those that fit together logically and shared the same common ideas. This then led to patterns in the codes, which allowed for themes to emerge. These themes that emerged from the coding process will be discussed further in the next chapter.

**Table 4.1: Coding of participants**

<b>Participants from school A and their codes</b>	<b>Participants from school B and their codes</b>	<b>Participants from school C and their codes</b>
Teacher (TA)	Teacher (TB)	Teacher (TC)
Learner AA (L1)	Learner AB (L4)	Learner AC (L8)
Learner BA (L2)	Learner BB (L5)	Learner BC (L9)
Learner CA (L3)	Learner CB (L6)	Learner CC (L10)
	Learner DB (L7)	

In the table above the researcher illustrates how the coding process was used for ethical purposes of confidentiality. In the first column are the participants from school A: the teacher is referred to as teacher A (TA), and learners from school A are learner AA (L1), learner BA (L2) and learner CA (L3). In the second column are the participants from school B: the teacher is referred to as teacher B (TB), while learners from school B are learner AB (L4), learner BB (L5), learner CB (L6) and learner DB (L7). In the third column are the participants from school C: the teacher is referred to as teacher C (TC), while learners from school C are learner AC (L8), learner BC (L9) and learner CC (L10).

#### **4.10 Ethical issues**

The researcher ensured that the study upheld the three most important ethical principles, which are autonomy, non-maleficence and beneficence. In terms of autonomy, the participants participated in the study voluntarily and could withdraw from it at any time, should they wish to. Permission to conduct the study was granted by all stakeholders. Regarding nonmaleficence, the researcher ensured that the study inflicted no emotional, physical, social or other harm on

anyone. The study is educational, and the teachers who were part of this study and their peers can scrutinise their teaching environments and respond to teaching problems in a scientific way. This study provides them with many advantages. Firstly, teachers become aware of any problems in their schools, and can easily identify these themselves. Secondly, teachers do not suffer anxiety if their colleagues monitor their teaching, and the researcher is one of their colleagues. Thirdly, teachers will readily collaborate with their colleagues as part of an ongoing teaching process, and gain confidence in their teaching and mathematical content knowledge.

The researcher obtained approval from UKZN to conduct the study. The research proposal was reviewed and approved by the Research Ethics Committee of the Faculty of Education (reference number HSS/0466/018M, Appendix IV). The KZN DoE also granted the researcher permission to go to schools and conduct research. The gatekeepers' letter (Appendix III) authorising the researcher to enter the premises, together with the letter for the principals informing them about the study, were granted by the KZN DoE. All participants were given the consent form to read and understand, and were able to ask questions if there was anything they did not understand (Appendix I and Appendix II). The researcher clarified all items on the consent form for the informants. After signing the consent form, the interviews session could commence.

As part of ethical integrity, an ethical clearance letter was obtained from the university. To ensure that participants were satisfied that this study would bring them no harm during data collection, they were shown the ethical clearance certificate to assure them that the study had been approved by the university ethics committee. It also provides proof of the authenticity of data collected and the processes that were used (Cohen et al., 2011). The researcher ensured that confidentiality and anonymity were maintained to ensure that at no stage could the informants be identified (Cohen et al., 2011). In this study the three school were referred as school A, school B and school C. The learners that were interviewed were referred as L1, L2, L3 L4, L5, L6, L7, L8, L9 and L10 and the educators were referred as Teacher A, Teacher B and Teacher C (see Table 4.1).

#### **4.11 Trustworthiness**

The trustworthiness of the data was assured by adhering to two criteria. The first criterion was triangulation through the use of multiple methods of data collection: semi-structured interviews and document review. The second criterion that was adhered to was that the data collected by the researcher automatically became part of the study; interviews were audio recorded and kept on computer discs should the ethical committee which to refer to them.

Trustworthiness and credibility of the study were addressed through honesty, depth, richness and scope of the data, the participants approached as well as the extent of triangulation and objectivity of the researcher (Cohen et al., 2007). In order to ensure that the results of this study can be trusted, triangulation was used, which involves the use of multiple data sources and research methods in order to corroborate research data as well as conclusions (O’Flaherty & Liddy, 2018). In this study, triangulation was used in the form of multiple data collection methods in order to strengthen the trustworthiness of the data. Data was collected over a period of three years (2016–2018) in the form of document review and interviews. Furthermore, ensuring trustworthiness involved maintaining the confidentiality of the participants by using pseudo-names in the interview transcripts as well as for the names of the schools.

#### **4.12 Limitations of the study**

Delays in data collection were the main limitation in this study because some data might be considered outdated. To minimise this limitation data was collected over a longer period in the subsequent years. Secondly, the 1+9 programme was implemented in 2015 and 2016, and teachers have undergone various professional development programmes. This might suggest that findings cannot entirely be attributed to participation in the 1+9 programme. However, the participants in this study confirm that post 1+9 they have not participated in any professional development programmes, not even the workshop on JIKA Imfundo which was implemented in 2018 in the Pietermaritzburg district. The findings of the study are not generalisable to other teachers and learners taught by teachers involved in the 1+9 or any other professional development programme. However, the researcher hopes that the findings will be rich enough

to inform the Department of Basic Education as to whether the programme achieved the purpose it was intended for, because the programme was escalated to Grade 7 without having conducted a study to explore if it had helped to improve learner performance. Being an outsider to the research site meant that participants first had to adapt to my presence before data could be collected. This meant having to spend time holding informal meetings with the school management and participants in order to develop a level of trust. While this delayed the data collection process, it yielded positive results because both learners and teachers were open to being interviewed and the school freely released the necessary documents to the researcher.

### **4.13 Conclusion**

The data collection phase took longer than expected as the researcher had to accommodate changes in times and dates coming from the informants' side. The informants were able to answer the questions on the question guide. Open-ended questions enabled the informants to give recommendations and suggestions for future research. Unexpected findings were encountered during data collection, which is good for the study as it allows the researcher to make more interesting suggestions for future research.

## Chapter Five

### Data Presentation and Analysis

#### 5.1 Introduction

The main aim of this chapter is to present and analyse the data that was collected to understand the phenomena underpinning this study, which explores Grade 9 mathematics learners' performance after their teachers have undergone the 1+9 programme. Not all schools participated in the programme, and the researcher selected three schools in the Vulindlela Circuit where the 1+9 programme was implemented as the research site. Sampling of the schools was done purposively, and the three schools which were selected are where teachers who were involved in the 1+9 programme are still teaching.

The chapter is divided into three main sections. The first section presents the mathematics results of the schools that participated in the 1+9 programme. These results are presented in tables and figures in the form of bar graphs. In the second section, the researcher presents responses from the interviews with three teachers (one from each school) who were part of the 1+9 programme. The researcher uses tables listing the questions and responses of each teacher, followed by analysis of their responses. Responses from the learners' interviews are also presented in tables and analysed. In the third section, the researcher describes the data analysis process and the themes that emerged.

The data collection process was guided by the following research questions:

- How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level?
- What do Grade 9 learners' written responses reveal about their competency in mathematics after implementation of the 1+9 programme?

## 5.2 Data presentation and analysis of learners' performance

To explore learner performance, data from the years 2016, 2017 and 2018 was analysed. In 2016 teachers were still participating in the 1+9 programme, and in 2017 and 2018 the programme had ended and teachers were expected to implement the knowledge they had gained at full scale. Data presented in this section was drawn from document analysis of the marks schedules for 2016, 2017 and 2018 for each of the three schools. The raw data is presented in tables, and the researcher calculated the mean for each year as shown below (Tables 5.1, 5.2, 5.3, 5.4) and use a bar graph (Figure 5.1) to illustrate the means. Although this is a qualitative study, the graph was found useful to illustrate the means for different schools. The aim is not to compare schools, but to explore the performance of learners across the three schools that have teachers who participated in the 1+9 programme.

The raw data and mean for each school is presented, then the graph illustrating the mean for the three schools for different years. For ethical purposes, the code LL with a number was used instead of giving the learners' names. The numbers do not indicate performance, but the alphabetical order as they appear on the marks schedule.

**Table: 5.1: Mathematics marks (%) for learners in 2016, 2017 and 2018 – school A**

NAME	2018	2017	2016	NAME	2018	2017	2016
LL1	17	44	40	LL22	15	11	40
LL2	19	25	40	LL23	11	41	40
LL3	16	15	21	LL24	18	16	40
LL4	10	31	40	LL25	19	43	19
LL5	16	25	27	LL26	10	41	40

<b>LL6</b>	19	32	40	<b>LL27</b>	9	32	19
<b>LL7</b>	21	40	13	<b>LL28</b>	15	27	40
<b>LL8</b>	15	30	13	<b>LL29</b>	18	22	40
<b>LL9</b>	13	25	40	<b>LL30</b>	19	30	14
<b>LL10</b>	13	26	40	<b>LL31</b>	20	45	41
<b>LL11</b>	21	24	40	<b>LL32</b>	17	15	28
<b>LL12</b>	14	26	21	<b>LL33</b>	19	18	24
<b>LL13</b>	11	24	40	<b>LL34</b>	21	30	25
<b>LL14</b>	11	29	12	<b>LL35</b>	14	22	40
<b>LL15</b>	12	34	40	<b>LL36</b>	12	31	24
<b>LL16</b>	22	32	11	<b>LL37</b>	14	26	22
<b>LL17</b>	12	25	40	<b>LL38</b>	17	15	14
<b>LL18</b>	19	35	22	<b>LL39</b>	18	16	40
<b>LL19</b>	20	23	20	<b>LL40</b>	12	16	14
<b>LL20</b>	15	34	12	<b>LL41</b>	24	26	36

<b>LL21</b>	13	23	12	<b>LL42</b>	17	33	26
-------------	----	----	----	-------------	----	----	----

**Table: 5.2: Mathematics marks (%) for learners in 2016, 2017 and 2018 – school B**

<b>NAME</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>NAME</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>
<b>LL1</b>	6	46	49	<b>LL23</b>	12	57	48
<b>LL2</b>	15	15	48	<b>LL24</b>	7	1	48
<b>LL3</b>	13	12	48	<b>LL25</b>	6	6	44
<b>LL4</b>	14	13	48	<b>LL26</b>	9	4	45
<b>LL5</b>	11	14	45	<b>LL27</b>	8	40	48
<b>LL6</b>	9	4	47	<b>LL28</b>	5	9	48
<b>LL7</b>	11	44	47	<b>LL29</b>	5	6	45
<b>LL8</b>	3	39	47	<b>LL30</b>	3	12	45
<b>LL9</b>	13	15	48	<b>LL31</b>	11	4	48
<b>LL10</b>	9	6	46	<b>LL32</b>	11	35	47
<b>LL11</b>	28	4	60	<b>LL33</b>	11	46	48
<b>LL12</b>	21	10	48	<b>LL34</b>	14	57	48

<b>LL13</b>	17	4	50	<b>LL35</b>	5	14	47
<b>LL14</b>	18	11	47	<b>LL36</b>	8	24	46
<b>LL15</b>	18	37	46	<b>LL37</b>	32	6	48
<b>LL16</b>	6	43	50	<b>LL38</b>	13	1	48
<b>LL17</b>	15	56	46	<b>LL39</b>	17	44	49
<b>LL18</b>	7	40	47	<b>LL40</b>	8	36	48
<b>LL19</b>	19	2	48	<b>LL41</b>	4	21	45
<b>LL20</b>	18	5	48	<b>LL42</b>	17	15	44
<b>LL21</b>	19	8	45				
<b>LL22</b>	26	14	95				

**Table: 5.3: Mathematics marks (%) for learners in 2016, 2017 and 2018 – school C**

<b>NAME</b>	<b>2018 C</b>	<b>2017 C</b>	<b>2016 C</b>	<b>NAME</b>	<b>2018 C</b>	<b>2017 C</b>	<b>2016 C</b>
-------------	---------------	---------------	---------------	-------------	---------------	---------------	---------------

<b>LL1</b>	15	8	23	<b>LL23</b>	14	35	11
<b>LL2</b>	9	35	40	<b>LL24</b>	17	51	11

<b>LL3</b>	12	23	40	<b>LL25</b>	18	24	21
<b>LL4</b>	22	38	18	<b>LL26</b>	25	32	16
<b>LL5</b>	31	11	40	<b>LL27</b>	17	23	40
<b>LL6</b>	11	17	40	<b>LL28</b>	18	15	40
<b>LL7</b>	16	27	40	<b>LL29</b>	25	30	40
<b>LL8</b>	14	25	40	<b>LL30</b>	45	9	40
<b>LL9</b>	17	24	42	<b>LL31</b>	15	31	17
<b>LL10</b>	13	5	40	<b>LL32</b>	15	29	22
<b>LL11</b>	16	19	13	<b>LL33</b>	13	21	40
<b>LL12</b>	15	8	40	<b>LL34</b>	23	36	18
<b>LL13</b>	19	15	14	<b>LL35</b>	14	16	17
<b>LL14</b>	15	21	40	<b>LL36</b>	20	14	40
<b>LL15</b>	20	41	40	<b>LL37</b>	19	27	40
<b>LL16</b>	22	27	13	<b>LL38</b>	13	24	40
<b>LL17</b>	23	1	22	<b>LL39</b>	23	46	25

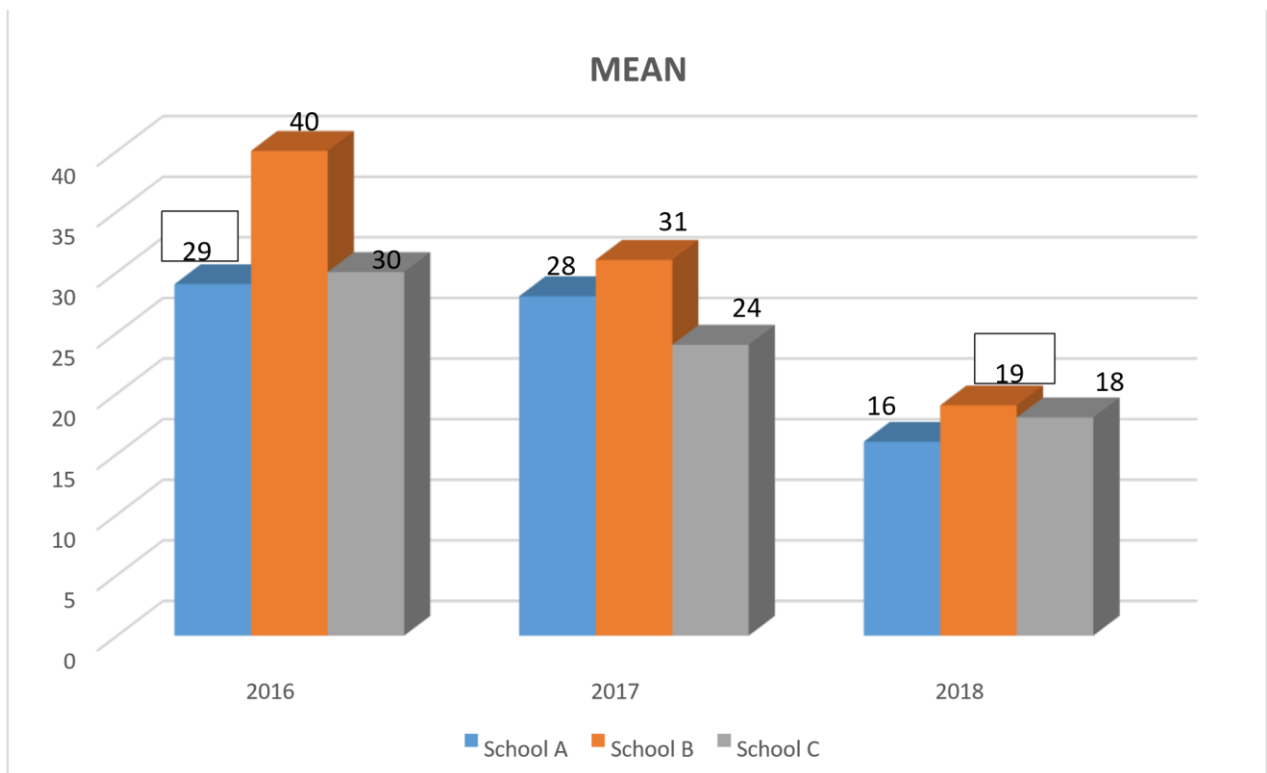
<b>LL18</b>	12	23	40	<b>LL40</b>	19	31	40
<b>LL19</b>	9	13	40	<b>LL41</b>	21	52	23
<b>LL20</b>	16	17	40	<b>LL42</b>	17	20	19
<b>LL21</b>	25	7	12				
<b>LL22</b>	12	20	16				

As mentioned in the previous chapter, on document review the researcher used the marks schedules for the 42 learners selected in each school in 2016 as the benchmark. In all three schools there has been an increase in the number of learners since 2016. However, the researcher opted to stick to the same number of students for each year – 42 per school. In school A there were 42 learners in 2016, and the researcher chose to analyse all the scripts. In 2017 and 2018 there were more learners than in 2016, and the researcher randomly selected the names of learners whose marks would be analysed and capped the number at 42. The same process was followed with schools B and C. After analysing the marks for each year in all three schools, the average for each year was calculated for each school, as illustrated in Table 5.4 and Figure 5.1

**Table 5.4: Mean mathematics marks (%) for each school for the three years**

	2016	2017	2018
School A	29	28	16
School B	40	31	19
School C	30	24	18

Table 5.4 and Figure 5.1 show the average marks of the 42 learners who wrote mathematics in schools A, B and C in 2016, 2017 and 2018.



**Figure 5.1: Mean scores (%) of the 42 Grade 9 learners who wrote mathematics in the three schools in 2016, 2017 and 2018.**

The mean for the Grade 9 mathematics marks in school A for 2016 is 29%, which is more than in the other years. In 2017 it dropped to 28%, and in 2018 it took a big drop to 16%. In school B the mean for the mathematics marks started out on high of 40% in 2016, then in 2017 it dropped to 31% and in 2018 it went down further to 19%. Lastly, for school C, in 2016 the mean mark for mathematics for the 42 selected learners is 30%, while in 2017 it dropped to 24% and in 2018 it dropped further to 18%. During 2016 the 1+9 programme was still in the pipeline, and teachers were still practising what was being offered by the programme. In 2017 the programme stopped, and the teachers went back to their old ways of doing things, which resulted in the decline in mathematics results; more learners were now failing mathematics than in 2016. In 2018 the mathematics marks of learners in Grade 9 dropped dramatically in all of the schools that participated in this study.

### **5.3 Presentation of data from interviews with the teachers**

Semi-structured interviews were conducted with three teachers who took part in the 1+9 programme. One teacher from each school attended the programme, and these became the participants in this study. This subsection describes in detail objective two of the study, which is to determine the extent of improvement in learner performance after the 1+9 programme from teachers' perspective, since they were the ones involved in the programme, not the learners; therefore, they are in a position to reflect on whether their participation in the programme has or has not yielded results in terms of improved learner performance.

The teachers were given the following codes teacher A (TA), teacher B (TB), and teacher C (TC), reflecting the schools they were from, i.e school A, school B and school C. The researcher explained the purpose of the interviews to the participants before the interview commenced. The reason for coding was also explained, in that it was to ensure confidentiality for the participants, which is why their names, school names and learners' names were not taken or listed for the purposes of this study. The duration of the interview sessions ranged between 30

and 60 minutes. The teachers were asked a total of 9 questions each, three teachers being interviewed in total, one per school.

All three teachers are qualified mathematics teachers: teacher A has a national diploma, while both teacher B and teacher C have a Bachelor's degree in Education. In terms of teaching experience, all three teachers had more than five years' teaching experience and all participated in 1+9 programme, and had been teaching at the same schools since 2016 when the programme was introduced.

As evident in the analysis of learner results since 2016, presented in Table 5.4, the performance in mathematics is declining. All the schools had a better average in 2016, but 2017 and 2018 learner performance declined. One of the goals of having teachers participating in 1+9 was to improve learner attainment; however, analysis of the results seems to suggest that after the 1+9 programme the results dropped, which is an indication that the programme is not sustainable in these three schools. In order to understand teachers' views on the matter, the researcher engaged with the teachers in the semi-structured interviews. The following are the questions and responses.

**Researcher: Why do you think that the results in mathematics are declining?**

**Teacher A:** Learners have a negative attitude toward mathematics; as a result, they do not focus in the class. Imagine if you do not like something, you will not pay attention if someone is talking to you about that.

**Teacher B:** Because learners have a negative attitude towards the subject some do not do their activities and home work. Since they are not practising, they fail when it's time to write the test.

**Teacher C:** Most learners in Grade 9 lack mathematics background, their knowledge is weak to a point that you are teaching a learner in Grade 9 but the knowledge the learner has is below even a Grade 7 learner. You end up not even knowing where to start to help such a learner. Also, the learners are not focused in the class – not because of learning issues, but because in the area there is gang violence, so some learners are

directly affected because they are part of the gang, [and] some indirectly because when these things happen, they affect you mentally.

Teacher A and teacher B strongly believe that a negative attitude towards mathematics is the main cause of the decline in results in mathematics, accompanied by learners not doing their work in class and at home. The negative attitude toward the subject means learners end up losing focus in class while the teacher is teaching. Teacher C stated that lack of a mathematics background is one of the reasons that learners performed poorly in the subject. If they were performing poorly in lower grades, there was a high chance that even when they get to higher grades, like Grade 9, they will still perform poorly. Furthermore, teacher C raised the issue of activities that take place in the surrounding communities where the learners live; some learners choose to focus on issues of importance in their communities rather than focusing on their school work. What is noticeable in the teachers' responses is that they consider the drop in performance as entirely the learners' fault. Since this study's focus was to ascertain learner performance post the 1+9 programme, not the causes of poor performance, the researcher decided to redirect the conversation to the 1+9 programme, as can be seen below.

**Researcher: In 2016 you participated in the 1+9 programme. Was this your first time participating in a professional development programme?**

**Teacher A:** No, I had attended other programme, but most of the programmes are one-day or two-day programmes. 1+9 programme is one programme that lasted for a year.

**Teacher B:** I have attended more than one, but mostly they were just short courses.

**Teacher C:** Since I started teaching, I have attended more than one programme.

To ascertain their understanding of how the programme aimed to improve learner performance, the researcher decided to ask a follow-up question.

**Researcher: Based on your understanding, what was the main goal of 1+9 and would you say it's being achieved when you look at learner performance?**

**Teacher A:** Mhhh ... [pause] this is a difficult question. What I know is that schools were selected based on their mathematics results, so the schools whose results were not good according to Department of Education, teachers from those schools were then selected to participate. So my understanding is that the Department was trying to assist the schools improve the pass rate. Remember that the focus in 1+ 9 was for us teachers to plan together and learn from the facilitators because their schools were doing better in mathematics. As I said, with the learners in this school the problem it's not teaching, the problem is learner attitude, so we need a programme to help us deal with learner attitude.

**Teacher B:** I would not say I know what the goal was, but I know that schools that did not have good results, teachers were called to participate, and schools that had good results, teachers from those schools were facilitators. We will sit together and plan, so I will say it was to improve teaching, hoping that would improve mathematics results. Perhaps in other schools – in mine, with some learners yes and with some it's not, because learners still do not like the subject and still they do not care to listen when I am teaching.

**Teacher C:** I am not sure what the goal was but schools were selected based on their mathematics results performance. Whether the goal of 1+9 is achieved with my learners, it's difficult to say. In 1+9 the focus was to improve teaching, but as I said, my learners lack background knowledge so it does not matter how much I will try to understand Grade 9 concepts, learners that lack background knowledge would not understand because it's beyond them.

What is evident from teachers is that while 1+9 aimed to address teaching, learners in these three schools have other challenges that hinder learner performance. Thus their participation in the 1+ 9 programme has not equipped them to deal with the challenges in their respective

schools, and hence learner performance is still not improving, but dropping instead. Another follow-up question revealed similar sentiments.

**Researcher: How are you using the experience you gained in the 1+9 programme in your mathematics classroom?**

**Teacher A:** As I said, the focus was on teaching. Yes now I know how to create resources for teaching and use practical objects when conducting the lesson, but as I have said, it has not helped much with changing learners' attitude towards the subject. We deal with different groups of learners; in one year you get learners who love the subject and your teaching is going well, and in some years you get learners who do not like the subject and the performance dropped.

**Teacher B:** From the 1+9 programme I gained the experience of planning a detailed lesson, but even though with my detailed lesson plan, some learners are still failing.

**Teacher C:** You see, I never used technology when teaching mathematics, after participating in the 1+9 programme I am using it. I would say it's helping because sometimes I can quickly explain the concepts which used to take me long when using the board. Then I will give learners tasks and have time to pay attention to those I notice that are lost.

**Researcher: How do you differentiate your teaching before and after you were involved in the 1+9 programme? How has this contributed to learner performance?**

**Teacher A:** Before, my main resource that I used was the textbook and I used to only make copies of the textbook. Now I know how to create additional resources. I can say I also gained in-depth information on how to handle low- and high-performing learners in class in a way that will make them feel equally important, thus generating a spirit of helping one another through working in pairs and groups. In terms of learner performance, I do not know.

**Teacher B:** As I have said, I now know how to plan a detailed lesson plan and conducting a lesson without relying on the textbook. But still with a detailed lesson plan

learners are still failing, which means there is more to learner performance than just a teacher planning a lesson and delivering a lesson. Because you can deliver a good lesson, but if the person you are teaching is not listening, he won't hear you.

**Teacher C:** For me, I never used technology, but now I gained resources that are mostly technological and I am able to use it and my learners are loving it and improving.

Teacher C believes the experience gained in the 1+9 programme of teaching using technology has yielded better results; however, the analysis of the results showed a different picture, as the learner performance has kept on dropping since 2016. Teacher A did not want to comment about learner performance but posited that she is now able to create her own resources. However, based on the analysis of results, this has not translated into improving learner performance. Teacher B agrees that what she has gained by participating in the 1+9 programme has not improved learner performance, as she posited that even with use of a detailed lesson plan, the learners are still failing.

#### **5.4 Presentation of data from interviews with learners**

The 1+9 programme was introduced with the aim of enhancing learner performance in mathematics. While it was teachers who attended the programme, the ultimate aim was directed towards learner attainment. Therefore, in this study that aimed to ascertain learner performance post 1+9, it was important that learners in schools that participated in the 1+9 programme and who were taught by teachers who were involved in the programme were interviewed to understand their perspectives on their competence in mathematics.

Interviews were conducted with 10 learners, 3 learners from school A, 4 from school B and 3 from school C. The learners' responses from the semi-structured interviews assisted in looking at objective three of the study, which is to determine Grade 9 learners' competence to solve mathematical problems, with a critical eye. Instead of using learners' names the researcher used

coding to ensure that confidentiality was maintained throughout the study. Learners were given codes, from learner 1 (L1) up to learner 10 (L10).

The conversations between the researcher and learners revealed the following about whether they considered it important to learn mathematics:

**L1:** It is important to learn mathematics, because after school one needs to find a job and mathematics is needed by many companies. People with mathematics do not struggle to find jobs.

**L2:** I need to learn mathematics, because every job needs maths.

**L3:** When applying to go to university, you will get a space quickly if you will study something with maths, and also you will get a job easily.

**L4:** Without mathematics, it's hard to get a job, so I have to learn it.

**L7:** I need to learn mathematics to get bursaries to go to university and find a job.

As evident in the above responses, five learners deemed it necessary to learn mathematics in order to meet their aspirations and goals post-schooling, of either studying at university or finding a job.

The other five learners gave a different response; for example, L6 had this to say: "I am learning mathematics because it helps with improving skills like counting skills and measurement." L8, L9 and L10 stated that they learn mathematics to improve their problem-solving skills:

**L8:** Learning mathematics helps with solving of challenging problems.

**L9:** Mathematics helps me and other learners to think critically and solve problems.

**L10:** Learning mathematics helped with learning skills to solve problems.

Although the learners deemed it important that they learn mathematics, and some pointed out that they have developed important skills such problem solving and critical thinking, this was

not reflected in learners' performance. Tables 5.1 to 5.3 showed that the Grade 9 learners' performance in mathematics was poor, especially in 2018. Learners had the following to say about why the performance in mathematics is poor:

**L1:** If learners do not participate in the class when the teacher is teaching, or if you think maths is hard, then you will not pass.

**L2:** For one to pass you need to understand, so if you do not understand, you will fail. Also, if you think maths is hard, you will not try – then you will fail.

**L3:** Learners who are failing are lazy, they do not practice. In mathematics you need to practice every day.

**L8:** Learners who fail are those who do not practice but copy from each other in class.

Four of the learners think that the performance in mathematics is determined by the amount of work one puts in to practice the learnt work. In addition, they felt that one's perception of the subject determines how they will perform; for example, they raised the point that thinking that mathematics is hard leads one to stop trying to succeed in it.

Of a different view were the other six learners, who believe that classroom behaviour reflects in one's performance in mathematics. For example, L5 said:

In the mathematics class you need to listen. Losing concentration when the teacher is teaching will lead to failing.

**L6 added:**

Learners who do not listen, pay attention or ask the teacher for clarity, tend to fail mathematics.

The same response was articulated by L7 and L9. The learners do not consider teachers methodology to have much impact on the performance. Even though the performance is poor but they believe that learner performance is related to learner's perception of mathematics and

learners' behaviour. With the aim to understand the processes the learners have been exposed by their teachers when it comes to solving mathematics, the learners had this to say:

**L1:** When the teacher is teaching, they tell us the steps to follow and formulas. When solving the problems I follow the steps given by the teacher.

The same sentiment was echoed by L2, L3, L4 and L5. L9 and L10 pointed out that beyond following the steps outlined by the teachers, they also practice alone and use the feedback given by the teacher when teaching mathematics to assist one another:

**L9:** After the teachers' instructions, we practice and do corrections in class that helps to see how each of us is doing.

L6, L7 and L8 went further, to say that working in groups enabled learners to assist each other.

**L6:** We work in groups and practice what the teacher has given us. We call the teacher to help us if we have challenges.

**L7:** We work in groups, help one another. If we have challenges, we ask the teacher for help.

**L8:** We practice more, we do all our activities and work in groups.

What transpired from the learners' responses is that the processes adopted in the mathematics classes are those of teachers teaching and learners following, and beyond that teachers use the strategy of teamwork to get the learners to assist each other.

## **5.5 Inductive analysis of teachers' interview responses**

Data from the interviews was analysed deductively using the constructs described in the framework presented in Chapter Three. Thereafter inductive analysis was carried out by identifying patterns in the teachers' and learners' responses that aligned with the research questions. The conceptual framework model in Figure 3.1 in Chapter Three is the best representation of what was adopted by the researcher in this study. The 1+9 programme

followed such a model; therefore, the research is taking us through constituents of the model presented in Figure 3.1. In this conceptual framework the researcher discussed aspects such as the resources for teaching, the teachers' content knowledge, the students' knowledge, and the curriculum quality and coverage.

### **5.5.1 Resources**

The 1+9 programme also provided teachers with the resources to use in the classroom, which included lesson plans, pace setters, work schedules and worksheets. Teachers were also taught how to include technology in their teaching. The teachers' interview responses confirmed that most teachers felt that their teaching methods had improved as a direct result of their participation in the programme. With regard to teaching strategies, most teachers agreed or strongly agreed that these had also improved:

**Teacher C:** We were given resources and also taught how to use technology in our classrooms.

**Teacher B:** We learned interesting ways of conducting a lesson without only relying on the textbook.

### **5.5.2 Teachers' knowledge**

The 1+9 programme provided the teachers with an opportunity to improve content knowledge. Shulman's (1986) definition refers to pedagogical content knowledge (PCK) as an in-depth understanding of how the subject matter must be taught. In this category the aspects of teachers' content knowledge and PCK in mathematics are considered, which includes teaching strategies, curriculum knowledge and its rate of coverage, lesson planning, assessment skills, and knowledge of learners' misconceptions.

### **5.5.3 Student knowledge**

Learners are not empty vessels that need to be filled with knowledge, they already have mathematical knowledge whether it's from the lower Grades or general knowledge. For learners to learn new mathematical knowledge easier, they must be able to integrate the already known with the new knowledge. The classroom environment must allow learners to be free such that they are able to share the knowledge and learners learn better from their peers.

### **5.5.4 Curriculum quality and curriculum coverage**

The 1+9 programme ensured that the teachers implement a curriculum of adequate quality, that caters for all learners and that learners can relate to real-life situations. The programme also aimed to ensure that the curriculum coverage improved.

Curriculum will be perceived in this setting to allude to what in particular is being instructed, how it is being conveyed, and how it is overseen (Jansen, 1998). Curriculum establishes the framework of what is to be instructed and the subtleties of what is being instructed (Matlali, 2018). It plays a significant role in deciding the status of students in terms of progressing to the following grade. Adequate coverage of the curriculum carries numerous advantages for the overall schooling framework, as it readies competent students to pass at a better rate.

## **5.6 Emerging themes from the teachers' interview responses**

To construct the themes that emerged from the data of teacher's interview, inductive analysis was done. The responses from the teacher's interviews that carry the same meaning were grouped together and collapsed into one theme. Examples of how the emerging themes were constructed are shown in Table 5.5. is illustrated in the tables below

**Table 5.5: Inductive analysis of teachers' interview responses**

<b>1. Understanding the aim of 1+9 programme</b>		<b>Emerging theme</b>
TA	Improvement of pass rate	<b>Improving teaching and learner results</b>
TB	Improving teaching and mathematics results	
TC	Improving teaching	
<b>2. Perspectives on the decline of learner performance post 1+9 programme</b>		<b>Emerging theme</b>
TA	Negative attitude	<b>Negative attitude and lack of background knowledge cause mathematics results decline</b>
TB	Negative attitude	
TC	Lack of background knowledge	
<b>3. Participation in professional development programmes including 1+9 programme</b>		<b>Emerging theme</b>
TA	Improvement of teacher content knowledge	<b>Teacher content knowledge, proper lesson planning and good practices improve learners' results</b>
TB	Improvement of lesson preparation	
TC	Improvement of teaching practices	

### **5.7 Participation in professional development programmes, including the 1+9 programme**

There is evidence that mathematics professional development programmes in South Africa are having an impact on learner attainment. All teachers had attended other professional development

programmes before the 1+9 programme. All participants stated that they did not know anything about the 1+9 programme until they attended it (Table 5.6). All participants stated that their schools were selected based on their performance in mathematics; teachers were selected for this study because they were teaching Grade 9 mathematics at the time of the 1+9 programme and to date.

**Table 5.6: Previous professional development and knowledge of the 1+9 programme**

<b>Researcher: Is there any other professional development programme that you attended before you were involved in the 1+9 programme?</b>
<b>Teacher A:</b> Yes, more than one.
<b>Teacher B:</b> Yes, more than one.
<b>Teacher C:</b> Yes, more than one.
<b>Researcher: Did you know anything about the 1+9 programme before you attended it?</b>
<b>Teacher A:</b> No.
<b>Teacher B:</b> No.
<b>Teacher C:</b> No.

Teachers A, B and C all explained their opinions on what they think are the most important characteristics of an effective mathematics educator.

TA stated that an effective teacher is a teacher who is willing to learn new things, because teachers are lifelong learners. TA also stated that an effective teacher should have an understanding of all learners in his/her classroom. If the teacher has a good understanding of each learner in his classroom, then he will be able to understand the level of the particular learner, in order to help them to perform better in mathematics. TB said that an effective teacher is one who is courageous and committed to learners’ understanding of the particular subject, and he/she should be creative with and passionate about the subject of mathematics. TC stated that an effective teacher must have good content knowledge, and must always be well prepared before going into the classroom.

**Table 5.7: Teachers’ opinions on the most important characteristics of effective mathematics educators**

<p><b>Researcher: According to your opinion, what are the three most important characteristics of an effective mathematics educator/teacher?</b></p>
<p><b>Teacher A:</b></p> <ul style="list-style-type: none"> <li>• Willing to learn new things</li> </ul>
<ul style="list-style-type: none"> <li>• Be able to understand both high- and low-performing learners</li> </ul>
<p><b>Teacher B:</b></p> <ul style="list-style-type: none"> <li>• Be courageous and committed to learners’ understanding</li> <li>• Be creative and passionate with maths</li> </ul>
<p><b>Teacher C:</b></p> <ul style="list-style-type: none"> <li>• Have good content knowledge</li> <li>• Be well prepared before going to class</li> </ul>

## **5.8 Inductive analysis of learners' interview responses**

The same process was carried out in analysis of the learners' responses to interviews, and the following are the themes that emerged from the data:

### **5.8.1 The role of mathematics in the post-school environment**

L1, L2, L3, L4, L5 and L7 all stated that mathematics is very important as a subject, and that when a learner has got good results in mathematics, they will get first preference by industry for jobs. Below is the related question and some of the responses. The question about the importance of mathematics was asked as follows:

**Researcher: Do you think mathematics is an important subject? And why?**

**L1:** Yes; if you are job hunting, companies consider your maths results most of the time.

**L2:** Yes, because every job needs maths.

.

**Researcher: According to your opinion, why are learners performing poorly in mathematics?**

**L3:** They are lazy and do not want to participate in class and practice on their own at home.

**L6:** They do not listen and pay attention, and do not seek clarity, do not do their homework and activities.

**L9:** Those that fail is because they have a bad attitude towards mathematics.

**Researcher: According to your opinion, why are learners performing well in mathematics?**

**L4:** They participate when the teacher is teaching.

**L6:** They concentrate and focus when the teacher is in class. They do their homework and activities.

**L4:** I practice along with the teacher, if there is something I did not understand I ask the teacher for more clarity.

**L2:** I practice what the teacher has told me to do.

- **Mathematics plays an important role in improving the lives of people**

Learners stated that mathematics is important in many ways, which it is a prerequisite for many courses at tertiary level, and that industry requires people who have mathematics skills.

- **Learners with negative attitudes to mathematics tend to perform poorly in the subject**

Learners said that a negative attitude to the subject is one of the contributors to the poor performance in mathematics.

- **Learners who participate in class tend to do well in mathematics**

Learners stated that they participate in the classroom practice and use the teacher's instructions in order to do well in mathematics.

- **Learners who ask for help tend to have good improvement in their mathematics performance**

L9 stated that having an effective mathematics teacher who enables learners to engage effectively in class and makes mathematics interesting promotes learner performance.

## **5.9 Conclusion**

This chapter presented the raw data obtained from the 2016, 2017 and 2018 Grade 9 mathematics marks schedules from the three high schools that participated in the 1+9 programme in uMgungundlovu District. It also presented the data from the interviews with learners who were taught by teachers who were part of the 1+9 programme and from the interviews with teachers who attended the 1+9 programme. It discussed all aspects of the secondary data from the learners' mathematics marks schedules, and the responses that arose during the interviews. In analysing the data using coding, major themes emerged from the interviews with learners and teachers. As the conclusion to the study, the findings with regard to the mathematics mark schedules and the interviews are discussed in Chapter Six, and related recommendations are presented.

## **Chapter Six**

### **Discussion and Conclusion**

#### **6.1 Introduction**

In this chapter the researcher presents a discussion of the data presented and analysed in the previous chapter. The researcher will look at the main objectives of the study and match them against the data which was presented. First, the researcher viewed documents by looking at the mathematics mark schedules for the years 2016, 2017, and 2018 for three schools that participated in the 1+9 programme. Second, the researchers viewed the responses of the learners and teachers who participated in the 1+9 programme, and considers the themes that emerged during the interviews against the study's main objectives. Finally, the researcher presents the recommendations, limitations of the study and conclusion.

#### **6.2 Main objectives of the study**

The two objectives of this study were the following:

- a. To determine the extent of improvement in learner performance post the 1+9 programme.
- b. To determine the Grade 9 learners' competence to solve mathematical problems after their teachers took part in the 1+9 programme

#### **6.3 Results for mathematics from the document review for 2016, 2017 and 2018**

The researcher reviewed the Grade 9 mathematics results achieved in the end of the year examinations in three schools that participated in the 1+9 programme. Table 5.4 shows that the mean of the mathematics Grade 9 marks for school A in 2016 was 29%, while in 2017 it was 28% and in 2018 it was 16%. For school B the mean mathematics Grade 9 mark in 2016 was 40%, in 2017 it was 31%, and in 2018 it was 19%. For school C the mean mathematics Grade

9 mark in 2016 was 30%, in 2017 it was 24%, and in 2018 it was 18%. It is clear that in all of the schools the mean mathematic mark in 2016 is slightly higher than in 2017, while in 2018 it decreases rapidly.

The research findings provide empirical support for claims that attending to teachers' mathematical knowledge can impact learners' attainment (Pournara et al., 2015). The teacher development improves learners' performance; in 2016 the teachers were still involved in the 1+9 programme, which is why we see that learners performed better in this year. The teachers were still using the trackers and lesson plans that they got from the 1+9 programme. When the programme stopped in the years 2017 and 2018, some teachers stopped using the practices they had learnt from the 1+9 programme, which is the reason why the performance dropped. The development programme for teachers must be continuous, to ensure that teachers are up to date with the current status of mathematics so that they will implement the current knowledge for teaching.

This section addresses both objectives of this study, which are “to determine the extent of improvement in learner performance post the 1+9 programme” and “to determine the Grade 9 learners' competence to solve mathematical problems”. The teachers' mathematical knowledge for teaching is vital in the performance of the learners in the subject. Teachers in the programme were empowered with content-based knowledge for teaching, and they were also supplied with supporting resources that are very helpful in delivering the content in the classroom.

In trying to answer the research questions, which are “How did the implementation of 1 + 9 programme improve learner performance in mathematics at grade 9 level?” and ,” What do Grade 9 learners' written responses reveal about their competency in mathematics after implementation of the 1+9 programme”. The 1+9 programme was implemented in 2015 and continued into 2016. Based on the average for each school, the results in 2016 were slightly higher than those achieved in 2017 and considerably higher than those achieved in 2018. Immediately after the 1+9 programme ended at the end of 2016, the results showed a drop in the performance of learners. While there can be many reasons for this drop, other than ending

the 1+9 programme, it is noticeable that once teachers were no longer involved in the programme, there was an adverse effect on learner performance. In concluding there was a change in the level of competence in the learners performance in mathematics, especially during the 2016, while the programme was still in the pipeline. This means that 1+9 programme should be the programme that teachers engage in on a continuous basis so that the learners are able to do well most of the time.

## **6.4 These are the teachers' perceptions regarding mathematics performance after the 1+9 programme.**

### **6.4.1 Teachers' qualifications and experience as well as understanding of the 1+9 programme**

Research has shown that the quality of the teacher is an important factor in ensuring positive results for mathematics performance in learners. Some researchers reveal that teacher quality has typically included factors such as class size, certification, type of qualification, degrees earned, or years of experience (OECD, 2010). All teachers that were participants in this study are qualified to teach mathematics at GET and FET level. The teachers stated that they have attended other developmental programmes before. The three teachers who were part of the study are all qualified mathematics teachers with mathematics as their major subject. It was important to ascertain teacher qualifications since the literature suggests that this is one of the elements that contribute to learner performance (OECD, 2010). In addition, teacher experience also plays a role in one's ability to navigate the intricacies of teaching. All three participants are qualified teachers by profession, all majored in mathematics, and all have more than five years of experience in teaching mathematics, making them experienced teachers in the field of teaching mathematics. A set of research studies conceptualises the teaching profession as a 'clinical practice profession' and compares it to the medical profession (Voss, Kunter, & Baumert, 2011). Some argue that decision-making is actually a basic teaching skill; decisions are regularly made by teachers while processing cognitively complex information about the student, in order to decide on alternatives for increasing their understanding. Therefore, teachers need to be empowered with knowledge.

Guerriero (2014) highlights many features that characterise expert teachers, which include extensive PCK, better problem-solving strategies, better adaptation for diverse learners, better decision making, better perception of classroom events, greater sensitivity to context, and greater respect for students. These are the traits that need to be re-invoked now and then in any teacher, which is why teachers much be developed continuously. The purpose of teachers' development programmes is to re-invoke these characteristics that have been mentioned, so that teaching and learning will be prioritised and occur at all times. The 1+9 programme helped teachers who attended to revisit some of the traits, and especially their content knowledge. Several studies stress the importance of the knowledge that teachers hold, highlighting that in addition to assimilating academic knowledge, student teachers also need to incorporate knowledge derived from experiential and practical experiences in the classroom. The DoE introduced the Integrated Quality Management System (IQMS), designed with the purpose of preparing an environment for teacher development, to monitor the overall effectiveness of the institution, evaluate the performance of the educator, identify the specific needs of educators for support and development, and promote accountability.

#### **6.4.2 Teachers' perceptions of the declining mathematics results**

Teacher A and teacher B strongly believe that a negative attitude on the part of learners is the main cause of the decline of results in mathematics, accompanied by learners not doing their work in class and at home. Due to a negative attitude toward the subject, learners end up losing focus in class while the teacher is teaching. Teacher C stated that lack of a mathematics background is one of the reasons that learners perform poorly in the subject; if they were performing poorly in the lower grades, they have a high chance of continuing to perform poorly in higher grades such as Grade 9.

In their responses about the declining performance of learners in mathematics, they said the main contributing factors are the lack of a mathematics background, and that some of their learners struggle to do a simple mathematics due to their carelessness. A bad attitude towards

mathematics as a subject results in learners not doing their homework, skipping mathematics lessons, absenteeism, and losing focus in class. One teacher mentioned social ills as another factor in the decline in learners' performance in mathematics. Poor performance in mathematics seems to be caused by teachers who lack the knowledge and skills to explain concepts clearly, and a shortage of Mathematics textbooks that focus pertinently on the prescribed curricula (Siyepu, 2013). It is also caused by teachers who do not understand mathematical cognition in learners (Henning, Van Rensburg, & Smit, 2004), as well as the fact that most South African learners have English as their second language and this adds to their struggle to learn mathematics. All the teachers said that the 1+9 programme was helpful to their teaching in terms of skills in teaching other topics of mathematics, and that they are now more confident in teaching certain aspects of mathematics content.

#### **6.4.3 The 1+9 programme improved the content knowledge and conduct of teachers**

Teachers A, B and C each stated that the resources (lesson plans, pace setters, and assessment tasks) that they obtained from the 1+9 programme have been very helpful in their teaching. They said they are still using the resources even after the programme; they now have less time to prepare, and the burden of doing lesson preparation has been eased. They now attend to each learner in their classroom, and the assessment standard is the same for all levels. The teachers also attained technological skill that they are now using in their daily teaching.

TA and TB stated how they had been using outdated methods of teaching in explaining the mathematical concepts, before they attended the 1+9 mathematics programme. After the programme they were able to use faster, modern techniques, and this helped in ensuring that most learners were able to understand the mathematics more easily. TC also said the 1+9 programme exposed them to different types of technologies that they can use to enhance learning, as well as different types of dynamic teaching to help them unpack the skills of teaching. The 1+9 programme also provided resources that helped the teachers to improve the rate of curriculum coverage. The participants blamed their failure to cover the curriculum on

there being many topics to cover in a short space of time, with learners who are not motivated and come from a background where learning is not prioritised. The teachers also stated that the kind of learners they taught were not academically motivated, and were not compliant if they were given school tasks like homework to complete. The 1+9 programme provided the teachers with tools to improve and manage the curriculum better. TA, TB and TC had seen that the 1+9 mathematics intervention programme was there to help educators to know about the curriculum plan they were teaching, and to be equipped regarding how to show it and follow it. In the wake of taking part in the programme, they clarified that the manner in which they broke down and conveyed the curriculum had without a doubt improved.

Mizell (2010) states that compelling professional development empowers teachers to build up the information and aptitudes they need to address students' learning difficulties. To be powerful, proficient advancement requires smart arranging followed by cautious usage with input to guarantee that it reacts to educators' adapting needs. Teachers who take part in expert improvement should put the new information and aptitudes that they gain to work. Professional development isn't successful unless it makes educators improve their guidance or makes administrators become better school leaders. Teachers' duty involves planning what to teach and how to teach it, and they need to understand their learners and the context of learning so that they can decide which pedagogical approaches may be best suited for particular groups of learners and their context. The positive impact that the 1+9 programme has had on the teachers' content knowledge was expressed by almost all of the participants

## **6.5 These are the learners' perceptions regarding mathematics performance after the 1+9 programme.**

The researcher interviewed 10 learners, 3 learners from school A, 4 from school B and 3 from school C. All of these learners are taught by teachers who were part of 1+9 programme. They were all asked four questions. All of the learners think that mathematics is an important subject. They differ in their reasoning for this; some think that mathematics gives learners more job

opportunities, while others think it gives them more opportunities to study further at tertiary institutions and that companies that offer bursaries prefer learners with mathematics as a subject.

As to why learners are performing poorly in mathematics, all of the learners agreed that there are learners who are not doing well and they are many in number. All learners gave different reasons for why this is so, the most common reason being that most learners perceive mathematics as a difficult subject. Other responses were that learners do not participate and focus in class, do not do their activities and homework, practice only when the teacher is in class, are afraid to ask the teacher for clarity when they battle with some calculations, copy other learners' work most of the time, and have a bad attitude towards teachers and towards the subject. Responses that differed from these were that learners that are doing well in mathematics focus in class, participate more, do their activities in class and also at home, practice most of the time, ask other learners for help, ask the teacher for more help and lead during correction time.

L6 stated that mathematics is important because it gives people counting skills. Mathematics is a prerequisite for many courses at the tertiary level of study. Learners also stated that students who have achieved good marks in mathematics get easy entrance to university. Mathematics helps students to be critical thinkers, and provides students with problem-solving skills. L8, L9 and L10 said that mathematics helps students with challenges and provides problem-solving skills.

Mathematics is a key subject for countries with emerging economies, since it enables learners to enrol for careers in the fields of engineering, the natural sciences, accountancy, and many others crucial to support economic development (Makgato & Mji, 2006). Most learners think that mathematics is required for anyone to get a job. Basic reasoning abilities are essential for learners to prevail in the future. Accordingly, the abilities of basic reasoning should be applied and created in main subjects and the teaching and learning process to deliver learners who have quality reasoning and will make future leaders. Consequently, it is essential to build up learners' basic deduction in all exercises and subjects, particularly mathematics. Mathematics learning shows numerical substance as well as building up basic reasoning abilities that are fundamental for

learners to tackle different issues in school or in public activity (Irvan, Jerusalem, & Habibulla, 2020).

L1 and L2 stated that learners think that mathematics is a hard subject, and L10 reiterated this statement by saying that there are parents that instil the negative mindset about the subject by saying that mathematics is hard. L3 stated that learners do not do their mathematics work, such as homework which is given to them, and others copy the work of their peers. Some learners lack confidence in the mathematics classroom, and are afraid to ask the teachers questions if there are things that they need to be clarified. Some learners develop a negative attitude towards mathematics which eventually leads to a negative attitude towards the teacher, and they do not do well in the subject. Learners who do not pay attention to the teachers while they are teaching do not do well in mathematics, because it is not easy to understand the subject without following what is taught in class.

L1, L4, L5 and L7 stated that the learners who do well are the ones that practice mathematics more, even at home, and focus well during class activity. L9 stated that an important role was played by having an effective mathematics teacher who enables learners to engage effectively in class and makes maths interesting. L10 stated that practising mathematics every day is the best way to learn it. L1 and L2 stated that they solve their mathematics problems by participating when the teacher is teaching, doing as the teacher instructs them to do and also completing all activities. Most learners also stated that good performance in mathematics was due to practising in class as well as when they are at home

## **6.6 Recommendations**

The 1+9 programme was started in another district in KZN and was then implemented in the uMgungundlovu District, and there was a resultant improvement in the learners' performance in mathematics. Based on the findings in this study, the programme must be continuous because when it stopped, the teachers stopped the helpful practices they learned from the 1+9 programme.

A recommendation is to ensure that the teachers continue to use the material that they obtained from the 1+9 programme. It should also be ensured that workshops take place regularly, every

term, which could contribute to better utilisation of the resources that enhance teaching and learning.

It is recommended that teachers continuously use a team teaching strategy, which could afford learners more opportunities to learn. Team teaching gives teachers an opportunity to share their skills, knowledge and expertise, and can strengthen the practices of all of the teachers who are part of the team.

It is recommended that teachers become members of professional bodies in mathematics, such as AMESA, so that they will be up to date with the current status of mathematics and current research being done in the field. Teachers need to be encouraged to acquire technological pedagogical content knowledge, which could enhance the performance of learners.

Teachers are lifelong learners, and it is recommended that teachers further their careers by obtaining postgraduate degrees; this could help teachers to stay up to date in terms of the current mathematics knowledge for teaching.

Educators must instil the culture of teaching and learning mathematics in the learners in order for them to have a positive attitude towards the subject.

## **6.7 Limitations**

The programme started as 1+4, where teachers in clusters planned together how to teach a particular topic, to be covered within a week by following the curriculum. It was later changed to 1+9, where a teacher teaches for 9 days and then meets with other teachers in his/her cluster for planning on one day in two weeks. This study focuses on the uMgungundlovu District, one of twelve districts in KZN; therefore it provides information on a small scale. Just three schools were picked in the district, which has over a hundred schools. Despite the fact that the point of this study was to provide an overview of the situation, utilising a bigger number of areas or schools would have provided superior comprehension around the attainment of students in schools that took part in the 1+9 programme. However, with such limitations being acknowledged, it does not mean that the findings are insignificant

## **6.8 Conclusion**

The researcher believes that the findings of this study will influence a positive attitude in teachers about teaching and learning mathematics, which will impact positively on learners'

results in mathematics. The study will pave the way for other researchers to do more research on teachers' development programmes to improve mathematics results.

The findings that have resulted from this study will serve to recommend to professional development organisations, the Department of Basic Education and other stakeholders that professional development of teachers takes place to ensure that they use the trackers, lesson preparation plans and pace setters and have a common assessment each term in Grade 9, to ensure that the teaching and learning of mathematics is taken seriously. The findings of this research could serve to encourage the DoE and the Departmental Head to do a thorough monitoring of the educators' work, to ensure that it is done properly.

Mathematics learning environments that encourage students to actively participate in open-ended investigations and explore multiple techniques and solutions can have a profound impact on students' critical and creative thinking skills (Kwan & Wong, 2014; Tandiseru, 2015; Tunca, 2015). A constructivist perspective of teaching and learning offers the potential for students to develop capability in critical and creative thinking skills (Australian Curriculum, Assessment, and Reporting Authority, 2013; Tunca, 2015). It is therefore integral that teachers provide experiences to learner to foster thinking skills, in order to prepare confident and informed students for lifelong learning beyond the classroom (Australian Curriculum, Assessment, and Reporting Authority, 2016). The study also found that the learners who are actively involved in the mathematics lessons are performing better in this subject.

## References

- Australian Curriculum, Assessment, and Reporting Authority (ACARA). (2016). *National Report on Schooling in Australia 2013*. Sydney: ACARA. ISSN 1036-0972.
- Adentwi, K.I. (2005). *Curriculum development: An introduction*. Ghana: WILAS Press.
- Adler, J. (2010). Mathematics for teaching matters. *Education as Change*, 14(2), 123–135.
- Adler, J. & Davis, Z.(2006). Opening Another Black Box: Researching Mathematics for Teaching in Mathematics. *National Council of Teachers of Mathematics*. , Vol. 37, No. 4: <https://www.jstor.org/stable/30034851>,
- Aksu, Z. & Umit, K. (2016). Exploring mathematics teachers’ pedagogical content knowledge in the context of knowledge of students. *Journal of Education and Practice*, 7(30), 35-42.
- Angen, M.J. (2000). Evaluating Interpretive Inquiry: Reviewing the validity debate and opening the dialogue. *Qualitative Health Research*, 10, 378-395. doi: 10.1177/1049732300010003
- Ansari, D., Maloney, E. A., & Fugelsang, J. A. (2011). The effect of mathematics anxiety on the processing of numerical magnitude. *The Quarterly Journal of Experimental Psychology*, 64(1), 10–16. doi: 10.1080/17470218.2010.533278
- Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General*, 130(2), 224– 237. doi: 10.1037/0096-3445.130.2.224
- Ball, D., Hill, H., & Bass, H. (2005). Knowing Mathematics for Teaching: Who knows mathematics well enough to teach third grade, and how can we decide. *American Educator*, 29(1), 14-46.

- Ball, D.L. (1991). Research on teaching mathematics: Making subject matter knowledge part of the equation. In J. Brophy (Ed.), *Advances in research on teaching, Vol. 2: Teachers' knowledge of subject matter as it relates to their teaching practice* (pp. 1–48). Greenwich, CT: JAI Press.
- Ball., S. (2017). *The Education Debate*. Bristol: Bristol University Press.
- Ball, L., Thames, H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389-407.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bansilal, S., Brijlall, D., & Mkhwanazi, T. (2014). An exploration of the common content knowledge of high school mathematics teachers. *Perspectives in Education, 32*(1), 34–50.
- Bernard, H. (2011). *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. New York: AltaMira Press.
- Bertram, C., & Christiansen, I. (2014). *Understanding research: An introduction to reading research*. Pretoria: Van Schaik Publishers
- Bertram, C. (2004). Exploring informal student study groups in a South African teacher education programme. In A. Tait & R. Mills (eds), *Rethinking learner support in distance education*. London: Routledge.
- Ball, D.L., & Bass, H. (2000). *Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics*. In J.Boaler (Ed.), *Multiple perspectives on the teaching and learning of mathematics* (pp. 83–104). Westport, CT: JAI/Ablex
- Beckner, G. (Ed.). (2008). *Education Matters*, October. Mission Viejo, CA: Association of

American Educators.

- Brijlall, D. (2014) Exploring the Pedagogical Content Knowledge for Teaching Probability in Middle School: A South African Case Study. *International Journal of Educational Sciences*, 7(3). doi: 10.1080/09751122.2014.11890234
- Brijlall, D., & Isaac, V. (2011). Links between content knowledge and practice in a mathematics teacher education course: A case study. *South African Journal of Higher Education*, 25(4), 680-699.
- Brijlall, D. (2011). A case study of lecturers' views on content knowledge and practice. In T. Mamiala & F. Kwayasi (eds) *Proceedings of the Nineteenth Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education, North-West University, South Africa*, pp. 34-50.
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education*. London: Routledge.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. New York: Routledge.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*. New York: Routledge.
- Cohen, J. (2006). Social, emotional, ethical and academic education. Creating a climate for learning, participation in democracy and well-being. *Harvard Educational Review*, 76(2), 201-237
- Creswell, J.W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: SAGE Publications.
- Creswell, J.W., & Plano Clark, V.L. (2011). *Designing and Conducting Mixed Methods Research* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Creswell, J. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson/Merrill.

Denessen, E; Abramovich, S; Grinshpan, A, Z & Milligan, L.(2019) *Teaching Mathematics through Concept Motivation and Action Learning*:Education Research International. Hindawi

Dennis, H., Mereku, D.K., & Alhassan, M.N. (2018). Influence of teachers' coverage of mathematics curriculum materials (MCM) on their schools' performance in mathematics. *African Journal of Educational Studies in Mathematics and Sciences*, 14, 33-38.

Denzin, N.K., & Lincoln, Y.S. (2005). *The SAGE handbook of qualitative research*. Thousand Oaks, CA: SAGE Publications.

Department of Basic Education (2014). *Report on the Annual National Assessment of 2014 Grades 1–6 & 9*. Pretoria: Department of Basic Education.

Department of Education. (2002). *Revised National Curriculum Statement Grades R- 9 (Schools), Mathematics*. Pretoria: Department of Education.

Department of Education. (2012). *Report on the Annual National Assessments 2012: Grades 1 to 6 & 9*. Pretoria: Department of Basic Education.

Department of Education. (2014). *The Centre for Development and Enterprise: What does research tell us about teachers, teaching and learner performance in Mathematics?* Pretoria: Department of Education.

Department of Education. (2016). *The National Assessment Circular No3:2016: Special Condonation Dispensation for Learners in the Senior Phase (Grade 7-9)*. Pretoria: Department of Education

- Dhlamini, J.J., & Mogari, D. (2011). *Using a cognitive load theory to account for the enhancement of high school learners' mathematical problem solving skills*. Kruger National Park, Mpumalanga: University of South Africa
- Di Martino, P., & Zan, R. (2009). 'Me and maths': Towards a definition of attitude grounded on students' narratives. *Journal of Mathematics Teacher Education*, 13. doi: 10.1007/s10857-009-9134-z
- Du Preez, M. (2018). *The factors influencing Mathematics students to choose teaching as a career*. Department of Education, University of the Free State, Bloemfontein, South Africa
- Elçi, A.N. (2017). Students' Attitudes towards Mathematics and the Impacts of Mathematics Teachers' Approaches. *Acta Didactica Napocensia*, 10. doi: 10.24193/adn.10.2.8 JO
- Enu, J., Agyman, O., & Nkum, D. (2015). Factors influencing Students' Mathematics Performance in some selected Colleges of Education in Ghana. *International Journal of Education Learning and Development*, 3(3), 68-74.
- Faridah S. (2004). *The ability to solve non-routine problems among high achievers*. Bangi, Selangor: University Kebangsaan Malaysia.
- Glesne, C.,E., & Peshkin, A. (1992). *Becoming qualitative researchers: An introduction*. New York: Longman.
- Graven, M., Venkat, H., Westaway, L., & Tshesane, H. (2013). Place value without number sense: exploring the need for mental mathematical skills assessment within the Annual National Assessments. *South African Journal of Childhood Education*, 3(2), 131–143
- Graven, M. (2016). *Teacher perceptions of the successes and challenges of a mathematics homework drive for primary learners*. Pretoria: Tshwane University of Technology
- Guerriero, S. (2014). Teachers' pedagogical knowledge and the teaching profession. *American Education Research Journal*, 47(1), 133-180

- Hammersley, M. (2013). On the ethics of interviewing for discourse analysis. *Qualitative Research*. doi: 10.1177/1468794113495039
- Heggart, K. (2016). *How important is subject matter knowledge for a teacher?* Retrieved from <https://www.edutopia.org/discussion/how-important-subject-matter-knowledge-teacher>
- Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education*, 21(1), 33-46. doi: 10.2307/749455
- Henning, E., Van Rensburg, W., & Smit, B. (2004). *Finding Your Way in Qualitative Research*. Pretoria: Van Schaik Publishers.
- Hurtado, S., & Carter, D. (1997). Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging. *Sociology of Education*, 70(4), 324-345. doi: 10.2307/2673270
- Irvan, M., Jerusalem, M., & Habibullah, H. (2020). The mathematics learning models for early grade students: contextual or problem-based learning. *Jurnal Aksioma*, 9, 551- 560
- Jacob, R., Hill, H., & Corey, D. (2017). The impact of a professional development program on teachers' mathematical knowledge for teaching, instruction, and student achievement. *Journal of Research on Educational Effectiveness*, 10(2), 379-407. doi: 10.1080/19345747.2016.1273411
- Jansen, J. (1998). Curriculum reform in South Africa: *a critical analysis of outcomes-based education*. *Cambridge Journal of Education*, 28(3), 321-331.
- Jojo, Z. M., Dhlamini, J. J., Phoshoko, M. M., & Ngoepe, M. G. (2014). *Exploring the mathematical proficiency of grade 6 teachers: A case of Gauteng Tshwane East*. Department of Mathematics Education, University of South Africa.
- Kreber, C. (2002). Teaching Excellence, Teaching Expertise, and the Scholarship of Teaching. *Innovative Higher Education*, 27(1).

- Kremer, M., & Vermeersch, C. (2005). *School meals, educational achievement and school competition: Evidence from a randomized evaluation*. Washington, DC: World Bank Policy Research Work Paper 3523.
- Kwan, Y.W. & Wong, F.L. (2014). The constructivist classroom learning environment and its associations with critical thinking ability of secondary school students in liberal studies. *Learning Environments Research*, 17 (2), 191–207
- KwaZulu-Natal Department of Education, 2018. *Mathematics Diagnostic Report in the KZN Province*. Durban: KwaZulu-Natal Department of Education.
- Luneta, K. (2015). Issues in communicating mathematically in rural classrooms in South Africa. *Journal of Communication*, 6(1), 1-9.
- Malambo, P., van Putten, S., Botha, H., & Stols, G. (2018). *Mathematics Student Teachers' Understanding of Trigonometry for Secondary Schools*. 11th annual International Conference of Education, Research and Innovation, Spain. Retrieved from <https://library.iated.org>
- Maloney, E.A, Ansari, D., & Fugelsang, J.A. (2011). Rapid Communication The effect of mathematics anxiety on the processing of numerical magnitude. *Quarterly Journal of Experimental Psychology*, 64(1), 10-16.
- Makgato, M. & Mji, A. (2006). Factors associated with high school learners' poor performance: A spotlight on Mathematics & Physical Science. *South African Journal of Education*, 26(2), 253-266.
- Makhubela, Y., & Luneta, K., (2014). *Factors attributed to poor performance in grade 9 mathematics learners' secondary analysis of annual national assessment(ANA)*. Johannesburg: Faculty of Education, University of Johannesburg.
- Marsh, C. J., & Willis, G. (2007). *Curriculum: Alternative approaches, ongoing issues. Fourth Edition* Upper Saddle River, N.J: Pearson/Merrill Prentice Hall.
- Marsh, C.,(2018) *.Planning, Management and Ideology: Key Concepts for Understanding Curriculum 2*, Upper Saddle River, N.J: Pearson/Merrill Prentice Hall

Matlali, I. (2018). *Exploring teachers' perceptions towards the 1+9 mathematics intervention programme for Grade 9 Mathematics teachers in Ugu District*. Durban: University of KwaZulu-Natal.

McLeod, D. B. (1994). Research on affect in mathematics education: a re-conceptualisation.

In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 575-596). New York: MacMillan.

Mesec, B. (1998). *Uvod v kvalitativno raziskovanje v socialnem delu./Introduction to Qualitative Research in Social field*. Ljubljana: Visoka šola za socialno delo.

Mizell, H. (2010). *Why Professional Development Matters*. Oxford: Learning Forward.

Mkhwanazi, T., Ndlovu, Z., Ngema, S., & Bansilal, S. (2018). Exploring Mathematics teachers' usage of the Curriculum Planner and Tracker in Secondary Schools in King Cetshwayo and Pinetown districts. In P. Christie & M. Monyokolo (eds), *Learning about sustainable change in education in South Africa*, 83, 195. Johannesburg: SAIDE,

Mohd, N., Mahmood, T. F. P. T., & Ismail, M. N. (2011). Factors that influence students in mathematics achievement. *International Journal of Academic Research*, 3(3), 49-54.

Mourshed, M., Chijioke, C., & Barber, M. (2011). How the worlds most improved school systems keep getting better. *Educational Studies*, (1), 7-25.

Ndlovu, Z., Amin, N. & Samuel, M.A. (2017). Examining pre-service teachers' subject matter knowledge of school mathematics concepts. *Journal of Education*, 70, 46-72

Ndlovu, A.Z. (2012). *Grade Twelve Learners' Construction of Knowledge of Optimisation problems*, thesis submitted in partial fulfilment for the degree of Master's in Mathematics Education, School of Science, Mathematics, and Technology Education. University of KwaZulu-Natal, Durban.

National Education Evaluation and Development Unit. (2012). *National Report 2012: The State of Literacy Teaching and Learning in the Foundation Phase*. Limpopo: NEEDU.

Neuman, W. L. (2003). *Social research methods: Qualitative and quantitative approaches*.

Boston: Allyn & Bacon

Nind, M., & Todd, L. (2011). Prospects for educational research. *International Journal of Research & Method in Education*, 34(1), 1-2. doi: 10.1080/1743727X.2011.552590

Núñez-Peña, M. I., Suárez-Pellicioni, M., & Colomé, À. (2016). Math anxiety: A review of its cognitive consequences, psychophysiological correlates, and brain bases. *Cognitive, Affective, & Behavioral Neuroscience*, 16(1), 3-22.. doi: 10.3758/s13415-015-0370-7.

PMID: 26250692.

Organisation of Economic Co-operation and Development (OECD), 2010, *Glossary of terms in evaluation and results based management*, Development Assistance Committee (DAC), Paris, France: OECD.

OECD. (2014), *Education at a Glance 2014: OECD Indicators*, OECD Publishing.

<http://dx.doi.org/10.1787/eag-2014-en>

O'Flaherty, J., & Liddy, M. (2018). The impact of development education and education for sustainable development interventions: a synthesis of the research. *Environmental Education Research*, 24(7), 1031-1049.. Doi: 10.1080/13504622.2017.1392484

Onwu, G., & Mogari, D. (2004). Professional development for outcomes-based education curriculum implementation', the case of UNIVEMALASHI, South Africa. *Journal of Education for Teaching*, 30(2).

Pournara, C., Hodgen, J., Adler, J. & Pillay, V. (2015). Can Improving teachers' knowledge of Mathematics lead to gains in learners' attainment in mathematics? *Journal of South African Education*, 35(3), 1-10.

Pournara, C. (2016). Deepening pre-service secondary teachers' mathematical content knowledge through engaging with peers' mathematical contributions. *Perspectives in Education*, 34(1), 135–149.

Radnor, H. (2002). *Researching your professional practice 5: Doing qualitative research*.

Buckingham: Open University Press.

Rahmah. (2018). *What makes a good curriculum?* SAFSMS blog. Retrieved from

<https://safsms.com/blog/makes-good-curriculum/>

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math anxiety: Past research, promising interventions, and a new interpretation framework. *Educational Psychologist*, 53(3), 145-164.

Reddy, V., Prinsloo, C., Arends, F., Visser, M., Winnaar, L., Feza, N., ... & Maja, M. (2012). *Highlights from TIMSS 2011: the South African perspective*

Reddy, V., Visser, M., Winnaar, L., Arends, F., Juan, A. L., Prinsloo, C., & Isdale, K. (2016). *TIMSS 2015: Highlights of mathematics and science achievement of grade 9 South African learners.*

Ritchie, J., & Lewis, J. (2013). *Qualitative research practice: A guide for social science students and researcher.* New Delhi: SAGE.

Riyami, A. T. (2015). Main approaches to educational research. *International Journal of Innovation and Research in Educational Sciences*, 2(5), 412-416.

Saldaña, J. (2015). *The Coding Manual for Qualitative Researchers.* Newcastle upon Tyne: SAGE.

Sapire, I., Shalem, Y., Wilson-Thompson, B., & Paulsen, R. (2016). Engaging with learners' errors when teaching mathematics. *Pythagoras*, 37(1), 1-11.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research Methods for Business Students* (7th ed.). Harlow: Pearson.

Saunders, M., Lewis, P., & Thornhill, A. (2012). *Research Methods for Business Students.* Harlow: Pearson Education.

Shalem, Y., Sapire, I., & Sorto, M.A. (2014). Teachers' explanations of learners' errors in standardised mathematics assessments. *Pythagoras*, 35(1), a254. doi:org/10.4102/pythagoras.v35i1.254

- Shavelson, R., McDonnell, L., & Oakes, J. (1989). Steps in Designing an Indicator System. *Practical Assessment, Research & Evaluation, 2*(12), 4-10.
- Showkat, N. (2017). Media & Culture: A Theoretical Perspective of the Inter-Relationship. *National Journal of Multidisciplinary Research and Development, 2*, 55-60.
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.
- Silverman, D. (2005). *Doing qualitative research: A practical handbook*. London: SAGE Publications.
- Silva, J.A., & Mosimane, A.W. (2013). Conservation-based Development in Namibia: A Mixed Methods Assessment of Economic Benefits. *Journal of Environment & Development, 22*, 25-50.
- Siyepu, S.W. (2013). The zone of proximal development in the learning of mathematics. *South African Journal of Education, 33*(2): Art. #714.
- Stipek, D., Givvin, K., Salmon, J., & MacGyvers, V. (2001) Teachers' beliefs, and practices related to mathematics instruction. *Teaching and Teacher Education, 17*(2), 213-226.
- Sturman, A. (1997). Case Study Methods. In J. P. Keeves (Ed.). *Educational Research, Methodology and Measurement: An International Handbook* (2nd ed., pp. 61-66). Oxford: Pergamon
- Suárez-Pellicioni, M., Núñez-Peña, M. I., & Colomé, À. (2016). Math anxiety: A review of its cognitive consequences, psychophysiological correlates, and brain bases. *Cognitive, Affective, & Behavioral Neuroscience, 16*(1), 3-22.
- Soiferman, K. (2010). *Compare and Contrast Inductive and Deductive Research Approaches*. ERIC, University of Manitoba.
- Tandiseru, S.R. (2015). The effectiveness of local culture-based mathematical heuristic-KR

- learning towards enhancing students' creative thinking skill. *Journal of Education and Practice*, 6(12), 74–81.
- Thomas, R. (2003). A general inductive approach for qualitative data analysis. *American Journal of Evaluation*, 27, 237.
- Tuimavana, R., & Datt, N. (2017). Teachers' Attitude Towards Teaching Mathematics at Upper Primary Levels in Fiji's Primary Schools: A Case Study of the Western Primary Schools. *International Journal of Humanities and Cultural Studies*, 3(4), 272-293.
- Tunca, N. (2015). The regression level of constructivist learning environment characteristics on classroom environment characteristics supporting critical thinking. *Eurasian Journal of Educational Research*, 60, 181-200.
- Vahedi, S., & Farrokhi, F. (2011). A confirmatory factor analysis of the structure of abbreviated math anxiety scale. *Iranian journal of psychiatry*, 6(2), 47.
- Vogel, I & Stephenson, Z., 2012, 'Examples of theories of change', DFID EVD, July 2012.
- Voss, T., Kunter, M. and Baumert, J. (2011). Assessing teacher candidates' general pedagogical/psychological knowledge: Test construction and validation. *Journal of Educational Psychology*, 103, 952-969.
- Wellington, J. J., & Szczerbiński, M. (2007). *Research methods for the social sciences*. London: Continuum International.
- Yin, R.K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: SAGE.
- Zan, R., & Di Martino, P. (2007). *Attitude toward mathematics: Overcoming the positive/negative dichotomy*. Montana: Montana Council of Teachers of Mathematics.
- Zuze, L., Reddy, V., Visser, M., Winnaar, L., & Govender, A. (2018). TIMSS 2015 Grade 9 national report: Understanding mathematics and achievement amongst Grade 9 learners in South Africa.

## **APPENDIX I**

### **INTERVIEW QUESTIONS GUIDE**

#### **QUESTIONS FOR THE TEACHERS**

1. What is your highest professional qualification?
2. How long have you been teaching mathematics in grade 9?
3. Why do you think that the results in mathematics are declining?
4. Is there any other professional development program that you attended before you were involved in 1+9 program?
5. Did you know anything about 1+9 program before you attended it?
6. How you were selected to be part of 1+9 program?
7. According to your opinion, what are the three most important characteristics of an effective mathematics educator/teacher?
8. How are you using the experience you gained in the 1+9 program in your mathematics classroom?
9. How do you differentiate your teaching before and after you were involved in the 1+9 program? Please provide a couple of examples.

## **APPENDIX II**

### **INTERVIEW QUESTIONS GUIDE**

#### **QUESTIONS FOR THE LEARNERS**

- 1 Do you think mathematics is an important subject? And why?
- 2 According to your opinion why learners are performing poor in mathematics?
- 3 According to your opinion why learners are performing well in mathematics?
- 4 How do you solve mathematics problems in your classroom?

## APPENDIX III: LETTER TO THE PRINCIPALS



education

Department:  
Education  
PROVINCE OF KWAZULU-NATAL

Enquiries: M.M.B. Mseleku  
033 3949121

Date: 18/ 04/ 2017

To: The Principal

Subject: Recommendation letter for Mr. S.E. Ngcobo (Student no – 200201775) to conduct a research at your school.

1. This document serves to confirm that Mr. S.E. Ngcobo (Student no – 200201775) is a student at UKZN.
2. You are kindly requested to allow him conduct a research at your school on the following topic: Exploring learner performance of grade 9 learners in Mathematics at the schools that participated in 1+9 initiative.
3. Thanking you in advance for your cooperation.

Yours faithfully

M.M.B. Mseleku

18/04/17  
Date

Umgungundlovu District: TLT – GET  
Email: Mduduzi.Mseleku@kzndoe.gov.za

## APPENDIX IV: ETHICAL APPROVAL



11 February 2019

Mr Edward Sazi 200201775  
School of Education  
Edgewood Campus

Dear Mr Sazi

Protocol reference number: HSS/0466/018M

Project title: Exploring grade 9 mathematics learner performance in schools that participated in the 1+9 programme

### Full Approval – Expedited Application

In response to your application received 16 May 2018, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

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

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

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

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

Yours faithfully

  
Dr Shamila Naidoo (Deputy Chair)  
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr Zanele Ndlovu  
cc Academic Leader Research: Dr SB Khoza  
cc School Administrator: Mrs Sheryl Jeenaarain

---

Humanities & Social Sciences Research Ethics Committee

Dr Rosemary Sibanda (Chair)

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag X54001, Durban 4000

Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4609 Email: [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za) / [snymanm@ukzn.ac.za](mailto:snymanm@ukzn.ac.za) / [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)

## APPENDIX V: TURNIT REPORT

---

4%	%	4%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

---

PRIMARY SOURCES

---

1	Norhatta Mohd, Tengku Farah Petri Tengku Mahmood, Mohd Nazri Ismail. "The level of patience and confidence towards problem solving and mathematics achievement of students in a technical institute", 2010 International Conference on Science and Social Research (CSSR 2010), 2010 Publication	1%
2	A Fikriyah, M Yasir, N Qomaria. "Analysis of pedagogical content knowledge on students of science education as pre-service teachers in Madura secondary school", IOP Conference Series: Earth and Environmental Science, 2021 Publication	<1%
3	Mojca Kukanja Gabrijelčič, Sonja Čotar Konrad. "chapter 9 Analyzing Teachers' Competencies in Regular Classroom Practice With Gifted Students in Slovenia", IGI Global, 2019 Publication	<1%

---

## Appendix VI: Participants Consent forms-Teachers

### RESEARCH CONSENT FORM

**Title of study:**

Exploring grade 9 mathematics learner performance in schools that participated in the I+9 programme.

Please read and complete this form carefully. If you are willing to participate in this study, ring the appropriate responses and sign and date the declaration at the end. If you do not understand anything and would like more information, please ask.

I have had the research satisfactorily explained to me in written form by the researcher.

YES /  NO

I understand that I may withdraw from this study at any time without having to give an explanation.

YES /  NO

I understand that any data collected will be used for research purposes and will be erased on completion of the research.

YES /  NO

I understand that the data will only be discussed within the research team

YES /  NO


I understand that study participants and their respective organisations will not be named in subsequent write ups and material submitted for publication.

YES /  NO

I understand that study participants and their respective organisations will not be named in subsequent write ups and material submitted for publication.

YES / NO

I freely give my consent to participate in this research study and have been given a copy of this form for my own information.

Signature: 

Name (capital letters)..... Z. K. ZULU (MRS)

Date: .....

Contact details: (include address, email and telephone number)

45 NIKBERG Rf. P. M. BUNG 3201

17 1061 2020

khumbuzilezulu@gmail.com

Cell no: 083 567 5026

**RESEARCH CONSENT FORM**

**Title of study:**

Exploring grade 9 mathematics learner performance in schools that participated in the I+5 programme.

Please read and complete this form carefully. If you are willing to participate in this study ring the appropriate responses and sign and date the declaration at the end. If you do not understand anything and would like more information, please ask.

I have had the research satisfactorily explained to me in written form by the researcher

YES / NO

I understand that I may withdraw from this study at any time without having to give an explanation.

YES / NO

I understand that any data collected will be used for research purposes and will be erased on completion of the research.

YES / NO

I understand that the data will only be discussed within the research team

YES / NO

I understand that study participants and their respective organisations will not be named in subsequent write ups and material submitted for publication.

YES / NO

I understand that study participants and their respective organisations will not be named in subsequent write ups and material submitted for publication.

YES / NO

I freely give my consent to participate in this research study and have been given a copy of this form for my own information.

Signature:  .....

Name (capital letters): LONDAINE MELROY MIELE (miss) .....

Date: 30/07/19 .....

Contact details: (include address, email and telephone number)

Regisiera High School .....

lonairle@gmail.com .....

060 623 9817 .....

.....

.....



## Appendix VII: Participants Consent forms-Learners

School of Education, College of  
Humanities, University of KwaZulu-Natal,  
Edgewood Campus

Dear Participant

### INFORMED CONSENT LETTER

My name is SAZI NGCOBO I am a MASTERS IN EDUCATION candidate studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. I am interested in INTERVIEWING YOU to gather the information, I am interested in asking you some questions.

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.
- The interview may last for about 45 minutes to 1 hour.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

Equipment	Willing	Not willing
Audio equipment	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Photographic equipment	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Video equipment	<input type="checkbox"/>	<input checked="" type="checkbox"/>

I can be contacted at:

Email: [sazziy@webmail.co.za](mailto:sazziy@webmail.co.za)

Cell: 079 591 2229

My supervisor is Dr Z Ngcobo who is located at the School of Education, Edgewood campus, University of KwaZulu-Natal (UKZN).

Contact details: Room CU 150, Main Tutorial Building, Edgewood Campus, UKZN.

email: [ngcobo.z@ukzn.ac.za](mailto:ngcobo.z@ukzn.ac.za)

Phone number: 031 2603784

You may also contact the Research Office through:

Ms. Mariette Snyman (HSSREC Research Office)

Tel: 031 260 8350

Email: [msnyman@ukzn.ac.za](mailto:msnyman@ukzn.ac.za)

Thank you for your contribution to this research.

**DECLARATION**

I.....*AMAILLE MASIFRIDA*..... (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

**SIGNATURE OF PARTICIPANT**

**DATE**

..........

**08/08/2019**

**SIGNATURE OF PARENT (If participant is a minor)**

**DATE**

..........

**08/08/2019**