

**Experiencing mathematics as a Black female – An
autoethnography**

by

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NOVEMBER 2019

Declaration

I declare that the dissertation, which I hereby submit for the degree of Magister Educationis at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.



.....
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November 2019

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Ethics Statement

The author, whose name appears on the title page of this thesis, has obtained, for the research described in this work, the applicable research ethics approval. The author declares that he/she has observed the ethical standards required in terms of the University of Pretoria's Code of Ethics for researchers and the Policy Guidelines for responsible research.

Dedication

I dedicate this thesis to my late father and to my mother. My father, who was diagnosed with motor neurone disease, passed away during the course of the completion of this thesis; he was always supportive and believed in my capabilities. My mother had a major impact on my mathematics experiences as she was the first mathematics teacher I had. I also dedicate this thesis to my grandmother and uncles, who have played a big role in enhancing my life in an extraordinary way.

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Abstract

This autoethnographic study was inspired by my own lived experiences with mathematics and mathematics education as a Black female. My study uses my voice to share my own history and my experiences of mathematics education. It was first inspired by my mother and later by my primary and secondary school teachers.

My autoethnography is situated within the South African context of continued unequal education provisioning along economic and racial lines. My autoethnography takes cognisance of my own context of being born a Black woman in a South African Black township. Therefore, Black feminist theory was deemed a relevant theory for the study. I personally conducted this study in order to tell my story to others who might find themselves in similar situations.

The study is approached from a qualitative perspective and uses autoethnography as the methodology. My mother, father, peers, and primary and secondary school teachers are used as the contributors in this study. I have made use of self-interview, personal memory, archival records and critical conversations to collect data. Through my autoethnography, I hope to fill the gap in the underrepresentation of Black females in mathematics.

Key Terms: Autoethnography, mathematics, gender, feminism, Black feminism, race, racism, Blackness, Whiteness, ethnomathematics.

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Kind regards,



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1. CHAPTER 1: CONTEXTUALISING MY AUTOETHNOGRAPHY

1.1 INTRODUCTION

In this study, I adopt an autoethnographic genre as a research methodology. This was inspired by John Dewey's idea of the centrality of lived experiences and experiential learning (Clandinin & Connelly, 2000; Clandinin, 2006). My study makes use of an autoethnography to re-experience my mathematics education as a learner in primary and secondary school. There are many reasons why we write about ourselves, how we start to write, and why we continue to write. As individuals, we all have our unique stories to tell about our personal lived experiences, about who we were in the past, who we are at present, as well as who we want to be in the future. Writing about ourselves links us intimately with ourselves and the reader.

Our behaviours and identities are different, as we are all born and raised in different contexts. Hence, our lived experiences do not exist in a cultural and social vacuum (Apple & Buras, 2006). How we respond to the world around us is relational, as it reflects our cultural and social contexts. We do not exist outside the world in which we live but we are shaped and groomed by our parents, families, friends, neighbours, colleagues, peers, structures, and organisations of society. In the very same manner, our educational challenges should not be isolated from the cultural, societal, and political context in which we find ourselves (Apple & Buras, 2006). As a result, we build our own knowledge about ourselves and society experientially through the past, present and future experiences of our lives (Clandinin & Connelly, 2000).

My autoethnography is in the form of a narrative and represents my personal lived experiences with mathematics education in a particular social and cultural context. Though my study is autobiographical, it is strongly linked to the society in which it exists, and this makes it autoethnographical. My study draws from my experiences as a Black female child doing mathematics at primary and secondary school level.

1.2 BACKGROUND AND CONTEXT

My experiences as a Black female occurred within the context of a racialised South Africa during apartheid and post-apartheid. Hence, my contextualisation focuses on the place where I grew up and the kind of educational environment in which I experienced mathematics education. My experiences were also strongly influenced by my family, especially the female members.

According to the South African History Archive (2013), during the apartheid era, the government put various acts of legislation in place, based on a racial hierarchy. For example, the legislative basis for racial ranking during apartheid was the Population Registration Act No. 30 of 1950. The South African population was divided into four main racial groups (Blacks, Whites, Coloureds and Indians) for social, political and economic purposes (South African History Archive, 2013).

During apartheid, it was especially Black African women who carried the burden of oppression in a four-fold manner, nationally, racially, by class and by gender (Schutte & Singiswa, 2013). Through this, Black women were more vulnerable to racist and sexist employment practices than White women or Black males. The oppression of Black females also became evident in mathematics education. Women, especially Black women, were largely excluded from South African mathematics education (Martineau, 1997). Thus, the new democratic African National Congress (ANC) government of 1994 chose to put the liberation of women, especially Black African women, at the forefront of the transformation of society (Neville & Hamer, 2006).

My autoethnography is also situated within the South African context of continued unequal education provisioning along economic and racial lines and it takes cognisance of my own context of being born a Black woman in a South African Black township. I was born in Tembisa, a township or *kasie* location that was established by the apartheid South African government in 1957, as part of its spatial planning to enforce racial segregation in towns, cities and metropolises in South Africa in terms of the Group Areas Act of 1950 (Mabin, 1992). The apartheid National Party (NP) government created Coloured, Indian and Black

townships on the periphery of the cities and towns as part of the spatial planning to separate races from one another (Pernegger & Godehart, 2007). Tembisa, meaning “hope”, was established as a Black township in the north of South Africa’s mining capital, Johannesburg. The township consisted of a mixture of informal and formal houses (Seekings & Natrass, 2005) and became the second-largest township in South Africa with a population of 463 109.

Johannesburg, also called *Joburg* or *Egoli* (place of gold), was established in 1886 when gold was discovered in the Witwatersrand by an Australian Prospector named George Harrison (Harrison, 2016). When gold was discovered, Johannesburg sprang up from the veld as a rowdy mining camp. The news spread like wildfire and the area experienced an unprecedented gold rush. Blacks from all parts of Southern Africa were imported to work in the mines for a period of time every year, during which time these migrant Black workers were separated from their wives and children and lived under inhumane conditions in so-called hostels (Harrison, 2016).

My study is also located within the history and effects of a racialised education system that was specifically influenced by the Bantu Education Act of 1953. The aim of the Bantu Education Act was to train Black children for the unskilled labour market and the Act was created to ensure that Blacks received inferior education compared to that of Whites, Indians and Coloureds (Le Roux & Wassermann, 2016).

Hendrik Verwoerd, academic and politician who became Minister of Native Affairs and later Prime Minister of South Africa, was regarded as the architect of apartheid. He proposed an education for Blacks that would make them “drawers of water and hewers of wood” for a White-run society and economy, irrespective of the aspirations and abilities of individuals (Thobejane, 2013:1). For him, there was no place for Blacks in the White community and nation above the levels of certain forms of labour. He stated: “What is the use of teaching the Bantu child mathematics when he cannot use it in practice?” (Clark & Worger, 2004:48). By this statement, he was implying that Black people should not receive mathematics education because they had to do the manual labour in the community. His notion

of the education of the Black child ultimately ensured that mathematics and science became scarce subjects in Black schools.

My autoethnography is also situated within the context of the new post-1994 democratic South Africa, in which young and upwardly mobile people, who identified themselves as Black, were confronted with new mental attitudes (Kok, 2015) and struggled to be accepted as equal to their White counterparts in different social structures. Despite the fact that the ANC government put policies and legislation in place to remove all forms of racial disadvantage and privilege, public education for Black children seems to remain inferior to that of Whites (Diko, 2017). Even though the South African ANC government wants to redress the injustices of apartheid, the heritage of the racialised society continues to disseminate and perpetuate White superiority and inequality in a more furtive way (Zungu, 2017).

1.3 RATIONALE AND MOTIVATION

Various reasons motivated me to conduct this study. Firstly, my study originated from a very specific personal experience. When I enrolled for the Bachelor of Education degree at the University of Pretoria in 2012, I was confronted by a White male student after we had written our first mathematics test. Informed by his White supremacist upbringing and his devaluation of Black females (ooks, 2000), he exclaimed in surprise, “Wow! This (Black) girl got a distinction in maths!”

He was sitting behind me with his two friends and when he saw my mark he was shocked. I recall how he reacted, with his eyes and mouth wide open, when he uttered those words. I was surprised by this reaction because I was used to scoring high marks in mathematics at primary and secondary school and no one had ever given me that kind of response. I turned around and looked at him and thought to myself: “Is this boy surprised at my mark, because I was a girl, or because I was Black, and he did not expect me to get marks higher than his?” It was then that I realised that I was good at mathematics. Previously I thought it was a natural ability, but the reaction from this boy really surprised me.

I was very good at mathematics from a very young age, excelling in the subject during my primary and secondary school years. As a result, my outstanding performance in mathematics opened a lot of opportunities for me. It was my performance in mathematics that allowed me to do the mathematics and science stream from grades 10 to 12. It was mathematics that qualified me to do computer application technology in high school. In addition, my achievement in mathematics in a township school opened the pathway for me to select mathematics for the Bachelor of Education degree. I was one of a select group of students who could do the subject based on their prior achievements and special requirements. Hence, I did not expect that kind of a reaction from the boy.

In addition, my study was influenced by my own epistemological assumptions (Creswell, 2013). My autoethnography is an alternative to Western philosophies by allowing me as a Black female to let my voice be heard from the margins and the bottom in an indigenous manner through storytelling. My study uses my voice to share my history and my experiences in mathematics education.

Through this study, I want to understand why there is an underrepresentation of Black females in the field of mathematics, while at the same time there are females like myself who love mathematics. I intend to tell my story to others who might find themselves in similar situations. I want to provide insight with regard to the provision of mathematics education in South African Black schools. This will also assist others to have a better understanding of the reasons for the high dropout rate of women, especially Black women in the mathematics field at secondary and tertiary school level.

This study was motivated by the possibilities of opening avenues for other marginalised individuals to examine their own experiences with formal and informal mathematics education (Harris, 2005).

1.4 FOCUS AND PURPOSE OF MY RESEARCH

The focus of my study is to re-experience the mathematics education that I received from my mother and teachers as a Black female prior to going to school and while I was a primary and secondary school learner.

The aim of my study is also to share my story with other people who are in a marginalised position in order for them to find the courage to succeed in mathematics in difficult situations.

1.5 MY RESEARCH QUESTION

My primary research question emerges from what motivated me to do the research as well as the focus and purpose of my study. The following question informed my study:

Why did I, as a Black female achieve success in mathematics in primary and secondary school?

1.6 THEORETICAL FRAMING AND CONCEPT CLARIFICATION

Theoretically, my study draws on race and feminism and is situated at the intersection of these concepts.

1.6.1 Feminism

Social and culturally, women are often treated with little respect in male-dominated society in which women are regarded as weaker and lesser than men (Ghorfati & Medini, 2015). The term feminism originated from the Latin word *famina* which describes the issues of women (Singh, 2004). It focuses on the experiences of females and highlights different forms of oppression to which women are subjected in society (Ghorfati & Medini, 2015). It is the belief in the political, economic and social equality of the different genders. Feminism is about attaining equal rights for women in a society in which they face greater discrimination than men. Feminism means that both women and men are equal and should be treated with equal respect.

1.6.2 Black Feminism

Black feminism is a modification of feminism that articulates the struggle of Black women. Black feminism emphasises the intersectionality of gender identity, sexism, racism and class (Mirza, 2014). Hence, Black feminism arose from an understanding of intersecting patterns of inequality. Black feminism concentrates on the notion of intersectionality, which is the idea that sexuality, gender, race and class cannot be divided or classified in lived experiences. If gender and race are studied separately, one cannot begin to explain how attitudes might change as a result of cross-pressure to lessen the interests of Black females so as to protect Black males (Simien, 2004). According to Perry, Kathi, & Oser (2013), a Black feminist, the experiences of Black women bring about a specific understanding of their place and oppression based on race, gender and class.

1.6.3 Race

Race, as a social construct, is a grouping of human beings based on shared physical or social qualities into categories generally viewed as distinct by society (Barnshow, 2008). Race does not have a biological or physical meaning but is socially constructed to classify people based on visual dissimilarities that are assigned to show invisible differences (Barnshow, 2008). The idea of race was invented by White European settlers in the 17th century in order to classify new groups of individuals being encountered and oppressed as part of an ever-growing European colonisation (Desai, 2010; Soudien, 2015). Race is regarded as both a colonial and an apartheid invention to organise the inhabitants of the colony and the apartheid state in order to keep non-Whites in a state of eternal oppression (Onwuachi-Willig, 2016; Soudien, 2015). Racial discrimination produced White superiority and Black inferiority (hooks, 2003).

1.6.4 Racism

Racism is defined as a belief in the power of one race above another (Newman, 2012). It may also mean discrimination, bias, or hatred directed against other people because they belong to a different ethnic group or race. Racism is a worldwide ladder of inferiority and superiority along the line of the human that has been culturally, politically and economically produced and reproduced for many years by the organisations of the “capitalist/patriarchal modern/colonial world-

system (Grosfoguel, 2016:10). It is a belief that certain races are lesser or greater than others, and that an individual's moral or social behaviours are determined by his or her innate biological characteristics.

The notion of racism has been of excessive rhetorical power in mobilising international action for political change in Southern Africa (Banton, 1992). Racism may be explained as a belief that a particular group of people is not fully human because of their skin colour, language, or any factor that exposes the nature of that particular group (Wijeysinghe, Griffin, & Love, 1997). The most dishonourable example of racism by the West has been oppression, mainly of Black Africans. This oppression was accomplished because of the racially prejudiced belief that Black Africans were less fully human than White Europeans and their offspring. In South African schools, the majority of racial events that happen can be categorised as implicit racism (Joorst, 2019) because, more often than not, racism in schools originates from institutional and structural racism. This is more difficult to identify from the outside than examples of racist behaviour or language.

1.6.5 Prejudice

Prejudice is classically theorized as an attitude that has a conative element such as a behavioural tendency to behave undesirably towards the target group and a cognitive element of such beliefs about a target group (Dovidio, Hewstone, Glick, & Esses, 2010). Prejudice may be directed toward a group as a whole or toward an individual because he or she is a member of that group. It can also be defined as a mechanism that sustains role and status differences amongst groups (Eagly & Diekmann, 2005).

Since the earliest expressions of racial prejudice were recognised, there is a form of derogation that attempts to adversely distinguish the Black, in a categorical way, as a race that is lazy, unintelligent and deceptive in its nature (McDonald & Crandall, 2015). Despite the fact that specific explanations of prejudice given by social scientists vary, most agree that prejudice consists of prejudgements that are typically negative about members of a group (Cohrs & Duckitt, 2012). In addition, prejudice includes stereotyped beliefs, negative feelings, and a trend to treat members of a group unfairly. It is almost twenty-five years into South Africa's

democratic release and racial prejudice is still happening in some schools in the country. Recently a teacher at a primary school was accused of splitting learners according to race, while elsewhere a secondary school was accused of holding back Black learners who had failed while moving White learners who failed to the next grade.

1.6.6 Blackness

Blackness is not merely about the colour of skin, but it is a social construct that is insistently regarded as being in opposition to Whiteness; meaning that it is not only that which explains Whiteness but is also inferiorised by it (Mapedzahama & Kwansah-Aidoo, 2017). A Black body in a white space has always been created as an “other” as well as an inferiority to Whiteness. According to Austin (2004), there is a burden of being Black. There are different kinds of negative situations that Black people experience because of their skin colour and, on such a fixed foundation, can be seen as creating a burden. Their Black skin colour, which follows them everywhere, causes them to be treated and seen in ways that are negative and as a result that often makes them uncomfortable (Mapedzahama & Kwansah-Aidoo, 2017). Blackness is always present and cannot be abandoned. It is frequently represented by a forced Black identity that decreases structural, regional and global inequalities to fixed features of individuals in ways that create a burden for them (Farrugia, 2010).

Before the encounter with people of colour in the 16th century, the White men had already given a different negative aesthetic and moral value to the word Black. According to them being Black was evil, dirty, devilish, ugly and deadly, compared to being White, which was meant to be good, clean, godly, beautiful and lively (Ohlsen, 2013). In South Africa, your Black skin colour had an influence on every aspect of your life. It influenced where you attended school, the kind of education you had, where you lived, who you interacted with, your political position and also your social relations.

1.6.7 Whiteness

Whiteness is the action to quieten the speech about race as not existing through a colour-blind awareness that often functions as a way of normalising the White

experience (Dray, 2008). A colour-blind point of view tries to rise above race by claiming not to see race as an issue; but, this mistakably undermines the lived realities that people experience through racial lines (Dray, 2008). Whiteness as a belief is standardised in its construction and sustained through machinery and capitalism, including the system of education, mainstream media, culture and religion, and the justice system (Schutte, 2015). This all ends in the main dialogue that maintains a whiteness system and ensures its authority. It is through these functions that white privilege becomes “invisible” to those who benefit from it and transparently intense to those who are constantly disadvantaged and oppressed by it (Schutte, 2015).

1.6.8 Mathematics

According to the South African Curriculum and Assessment Policy Statement (CAPS), which is the national curriculum for the country Mathematics is a language that uses notations and symbols for describing geometric, numerical and graphical relationships. It is the human activity that comprises spotting, investigating and representing patterns and descriptive relationships in social and physical phenomena. Problem-solving in mathematics allows us to make sense of the social and physical world around us and teaches us to think artistically.

Since ancient times, mathematics has been essential to the developments in engineering, science and technology (Burton, 2011). It has advanced from simple counting, calculations and dimensions, and the regular study of figures and motions in physical objects, through the presentation of reasoning, thoughts and abstraction, to the extensive, multifaceted and often intellectual discipline we know today (Ziegler & Loos, 2017). Greek mathematicians were the first people to pay attention to universal rather than definite results (Burton, 2011; Hom, 2013), while the Egyptians used calculating aids to help with finding parts of a fraction (Furman, 2017). The focus of their problem-solving strategies was on finding answers to particular questions instead of focusing on finding general patterns of solution.

Rosa and Orey (2011) define mathematics **as** a collection of symbolic processes and demonstrations that are traditionally created and that simplify the management of these demonstrations. Learners develop processes and

demonstrations into their cognitive coordination, which is a procedure that takes place in a set of activities that are socially constructed (Rosa & Orey, 2011). This means that the mathematical skills that learners acquire in schools are not rationally constructed, that is, based on intellectual cognitive structures, but rather copied out of a mixture of earlier assimilated skills and knowledge and new traditional inputs. Therefore, D'Ambrosio (1990) confirmed that mathematics ascended out of the needs of structured society, which cannot be separated from the practices and activities established by individuals in a globalized society.

Most students think that mathematics is a set of processes that need to be followed (Setati, 2002). They believe that mathematics is only for gifted people. This suggests that the way mathematics is frequently taught does not provide opportunities for them to gain access to mathematical knowledge. Rather, it hinders students from identifying with mathematics and having a desire to become mathematicians. Consequently, mathematics has a problem with diversity (Laba, 2014).

1.6.9 Ethnomathematics

The term ethnomathematics arose in the year 1982 out of the consciousness of the common interaction and connection that occurs between political culture and mathematical culture (D'Ambrosio, 2001). Ethnomathematics has been described as the association between numerous fields where mathematics is used, historical backgrounds of mathematical content, numerous branches of mathematics, and the links between the world of mathematical work and the real world (Rosa, 2011)

Ethnomathematics involves both the cultural background and cultural foreground of the learners, because their lived experiences and future expectations are taken into account with regard to how they succeed in mathematics (Vithal, 2012). D'Ambrosio (2001) defines ethnomathematics as being made up of the ethno and the mathematics. The ethno is regarded as all the components that form the cultural characteristics of a group such as language, values, beliefs, clothing and food, and physical qualities, while mathematics is perceived as arithmetic, ciphering, ordering, modelling and inferring. Rosa and Orey (2003) divides

mathematics into mathema and tics. Mathema means to understand and explain the world in order to rise above, and to be able to cope with reality so that the members of a cultural group can live and flourish. Tics refer to the techniques such as ordering, counting, weighing, sorting and so on. Mathema develops the tics in the setting of ethnos since it is made of everyday problems faced by individuals, bigger problems of the human race, and human endeavours to create a meaningful world (Rosa & Orey, 2003).

1.7 RESEARCH METHODOGY

For me to propose answers to the research question I posed, planned and conducted this research study by methodically following a well-defined process. During the process of this research study, I had to make decisions on the research paradigm, research approach, research design, and sampling of participants, as well as the methods of collecting and analysing data. I approached this research study from a qualitative perspective, which allowed me as a researcher to have an in-depth understanding of how I succeeded in mathematics as a Black female. I have made use of autoethnography as a methodology since it gives me an opportunity to explore my history from a personal point of view, in relation to the socio-political events of the time, academic experiences and other happenings that imposed on my life. Adding to that, I used the interpretive paradigm to interpret and make sense of day-to-day events, experiences and social structures.

The methods employed in this study were archival visits and records, self-interview and memory work, as well as critical conversations. The data collected was analysed using narrative analysis. I have described these aspects together with the sampling in chapter 3.

1.8 OUTLINE OF MY STUDY

The first chapter serves as an introduction to the study by setting the foundation of the study, highlighting the background, and explaining the frame and cause of the study. In this first chapter, I have highlighted the context of the study. In addition, I have also explained the motivation and rationale of my study, the focus and purpose as well as the research question that needs to be answered. This chapter sets the section and describes how the rest of the thesis will unfold. Chapter 2 is

the literature review. The focus was on providing a solid foundation wherewith to understand why there are few females in mathematics. The conceptual framework and theory of the study are also found in chapter 2. Chapter 2 is concluded with the theory of the study, which is Black feminism. The third chapter fully explains the research design and methodology with regard to the research approach and the methods that were used to gather and analyse the data. The data collection methods included self-interview and memory work, archival visits and records, critical conversations, as well as reading other people's autobiographies. The data is analysed narratively. Aspects such as trustworthiness and validity are also reflected on, to ensure that the weaknesses and strengths of the methodology and methods are carefully questioned. Chapter 4 consists of my narrative, which is divided into six sections: Life before school, first mathematics experiences, My formal mathematics lesson, the boring mathematics, learning mathematics in English, and Secodary school mathematics. In chapter 5 is a narrative analysis of my autoethnography. The last chapter, which is chapter 6, consists of the conclusion of my study. I concluded the study by discussing the major findings of the research study and giving recommendations for further research.

1.9 CONCLUSION

In this chapter, I provided an overview of my study in which I contextualised my personal lived experiences with mathematics education as a Black female. Chapter 1 defined the background, focus and purpose, motivation and rationale, and methodology of the study. I further highlighted the rationale of the research, focus and purpose, and the research question that guided my study. Finally, I give a brief overview of the theoretical lens and research methodology employed.

I concluded chapter 1 with a summary of the research study by giving a preview of the chapters to follow. Chapter 1 functioned as a route map to my research study. In the next chapter, I will be focusing on the conceptual framework and the literature review. I will provide an in-depth review of the literature on the under-representation of Black girls, the nature of mathematics, ethnomathematics, as well as critical mathematics education.

2. CHAPTER 2: GROUNDING MY AUTOETHNOGRAPHY IN LITERATURE AND THEORY

2.1 INTRODUCTION

In this chapter, I provide a scholarly argument for my study by linking it to the existing literature on my research topic. Through this, I situate my research in the scholarly domain of empirical research (Bertram & Christiansen, 2014; Creswell, 2013). The purpose of the literature review is to provide background information about my topic and to strengthen and justify my research methodology (Ridley, 2012). Through an exploration of the literature, the researcher is able to see how other researchers have approached a similar problem in terms of the methods of data collection and the findings that emerged from their research (Baker, 2016; Hart, 2018).

The review of literature is not merely a summary of the research of others. Instead, it is a critical engagement with the existing scholarship on the topic through a purposeful, focused, comprehensive, contextualised and systematic analysis of the studies of other scholars (Hofstee, 2006; Shunda, 2007). Through the literature review, I was able to discover significant experimental techniques, methods and concepts that are used in my field of study (Galvan, 2006). The literature review in this chapter focuses on the following themes: the power of mathematics, race and mathematics, gender and mathematics, culture and mathematics, and ethnomathematics.

2.2 MATHEMATICS AND POWER

There is the notion that mathematics is presumed to be difficult, cold, theoretical, ultra-rational and abstract (Setati, 2002). Mathematics is also regarded as unreachable and preserved for a few selected superintelligent individuals, who are mathematically intellectual (Setati, 2002). In many secondary schools in South Africa, when the learner has to choose subjects for the Further Education and Training (FET) phase, the mathematics marks that they achieved in the General Education and Training (GET) phase play an important role in determining whether they qualify to do mathematics and science in the FET phase. For example, a

learner with a mark less than 50% is not encouraged to do the mathematics or science subjects in the FET phase.

Through a case study, Vakharia (2013) recounts her experiences of struggling with mathematics in grade and her negative attitude towards mathematics. She failed grade 11 twice and her failure was based on the perception of the difficulty level of mathematics and not being inspired by the subject or her teacher. However, her perceptions about the subject was changed through the motivation and encouragement of a new teacher. The teacher, through sensible methodologies and pedagogical insight, convinced her that she was capable of doing something she had never thought possible. Through the intervention of the teacher, she was able to achieve results that enabled her to gain access to tertiary education and even become mathematics teacher herself.

Mathematics is often regarded as a source of power and economic status in South Africa (Setati, 2002). Through this perception of power, the subject is often used as a decisive filter to control access to areas of highly developed study, which in turn leads to fulfilling and highly remunerated professional careers. Kusmaryono (2014) recognises the significant role that mathematics plays in realising material wealth for individuals in the 20th century. For example, in the selection of candidates for bursaries and employment, mathematics is regarded as an important criterion (Kusmaryono, 2014). The notion of employability is confirmed by Ojo (2018) in a study of female students who found it challenging to be admitted to tertiary education due to poor mathematics and science results, although they had passed other subjects with exceptional grades. Shezi (2015) states that every skill that is listed in the top 100 careers that are scarce requires learners to have mathematics. This shows that mathematics is a gateway subject to high paying jobs. Without mathematics, you can only have access to very few professions. When my friend and I were applying for higher education positions, mathematics was used as a requirement for admission. My friend was not accepted for computer science because of her poor mathematics marks. She ended up doing BA criminology. In addition, mathematics also functions as a doorkeeper, an arranging instrument used to keep those people who become unsuccessful to learn and achieve at the required levels (Martin & Gholson, 2010).

2.3 RACE AND MATHEMATICS

Race continues to play a role in the offering and success rate of mathematics in South African schools (Villette, 2016). As a result of the apartheid past, South Africa inherited an unequal education system (Roberts & Venkat, 2016; Sokutu, 2019; Villette, 2016). Despite the collapse of apartheid, the South African education system still faces challenges in reducing inequalities and establishing quality education for all races (Mckeever, 2017; Osman, 2015; Roberts & Venkat, 2016).

Many townships in South Africa were dynamically involved in the opposition of the Bantu Education Act, an act that was created to provide Black Africans with skills that would enable them to work in manual labour jobs under the control of Whites. Bantu Education prevented and disadvantaged the majority of Black people for many decades, and its devastating political, personal, and economic impact continue to be felt even today (Villette, 2016). While apartheid education was abolished after democracy 25 years ago, education in South Africa continues to be unequal for Black and White learners (Sokutu, 2019). Many Black children still receive a type of education that sentences them to the lowest social level in the country while others do not have access to mathematics at all. In South Africa, there are still large numbers of schools that do not offer mathematics in the FET phase because of the lack of educational resources and shortage of qualified teachers (Shezi, 2015).

The dysfunctional education system of South Africa is one of the ways in which the government of the country discriminates against Black people. 80% of the schools in South Africa are dysfunctional, with the majority being Black township schools (Wilkinson, 2015). The difference in the allocation of resources has a negative effect on the quality of education of Black children. Many of the Black schools in townships, on farms, and in rural places have a shortage of resources in terms of instructional materials. Also, many students in these townships and rural places have only seen their teachers working on a chalkboard, and if lucky, with chalkboard instruments. I am a mathematics teacher at a primary school in Tembisa and the only resource that my learners have been exposed to is the

chalkboard. There are not enough textbooks for the students meaning that they may share a textbook, which they are not allowed to take home. As a result of unequal and separate development, the Black population is seriously underperforming in mathematics.

Another educational deficit left by the apartheid government is that of persistent poverty and high levels of residential segregation (Fiske & Ladd, 2005). Black children do not have access to the high-quality schools of White children as a result of the devastating success of apartheid's discrimination mechanisms. For the majority of Black children who live in the townships of major cities and who can afford the cost of transportation, getting to good schools in the White areas would take few hours of travel; and for children who live in the former Bantu homelands those high-quality schools hardly ever exist.

A statement made by former apartheid prime minister, Hendrik Verwoerd, about not offering mathematics to African children had an effect on those who had access to mathematics, as well as who had the ability to teach it. In democratic South Africa, the government tried to design a more equal system of education where all learners, regardless of race, have access to mathematics (Roberts & Venkat, 2016). However, the teaching of mathematics in Black South African schools is still very poor (Osman, 2015). I have noted that there are still many Black public and private schools having unqualified or underqualified teachers teaching mathematics. I have also noted that many public schools do not have proper infrastructure or education materials, learners are being poorly trained, and many of them live in economically miserable societies. When we turn a blind eye to the poor mathematics teaching in the majority of Black schools, we deny many learners entrance to higher education and knowledge-intensive work skills (Ojo, 2018).

2.4 GENDER AND MATHEMATICS

Women in South Africa continue to be underrepresented in mathematical and science related careers (Botha & Rasool, 2011; Vithal, 2012). Gender discrimination does not occur within a vacuum but interacts with race (Shepherd, 2017). This does not only have implications for the growth and economic

development of the country but also for social discrimination, as women continue to have less access or opportunities to high paying employment compared to males (Shepherd, 2008).

A survey by UNESCO in 2015 showed that around the globe, females make up less than 30% of people working in science, technology, engineering, and mathematics careers. I believe that in South Africa the problem is exacerbated by the apartheid history of the country. Dlodlo and Beyers (2009) agree that even today, many Black females are still finding it difficult to access careers in mathematics and science. The misrepresentation of women in mathematics and science starts in secondary school and prevails at tertiary level (Martin, 2015). Hence, many countries have focused on policies that promote greater representation of females in mathematics (Munoz-Boudet, 2017).

Gender inequality is further reflected in the curriculum and textbooks (Belbase & Panthi, 2017) that are used in our schools. Moletsane and Reddy (2011) posit that the kind of mathematics that is taught in schools, and the way it is taught, is female unfriendly. For example, illustrations and activities in textbooks tend to be male-oriented. Society, as well as our curricula, institutions, and teaching methodologies, were created by men and imitate the goals and life experiences of men. For example, Pythagoras' Theorem was developed by a man by the name of Pythagoras. He believed that everything is a number and we can understand the physical world through numbers. Also, Calculus was developed by a man, Isaac Newton, an English male mathematician who is widely known as the most important mathematician of all time.

Many female students have a greater ambition for careers in mathematics than their male peers; yet, very few make it to the doctoral level (Riegler-Crumb, Moore, & Ramos-Wada, 2011). Females are underrepresented in the field of mathematics when compared with other subgroups. Gender, as defined by society, creates favouritism within the field of mathematics (Joseph, 2017). A focus on gender alone, in South Africa, creates benefits for males, mainly, White males (Vithal, 2012). Overlaying gender with class, we see that poor females are the worst off in South Africa, especially women from the rural areas (Vithal, 2012). Gender also

intersects with race. McClellan (2012) in her autoethnography states that somehow along the way she learned that she needed to reject her womanness so she could accept her Blackness because gender and race intersected daily in her life and affected her interaction with others. Within a group of White people, it was hard for her to distinguish if her gender or race was affecting her interaction. However, with Black men, it was her gender. In a group of Black men, Black women are just outsiders who participate; they do not hold full membership.

The experiences of girls in mathematics remain largely untheorized and invisible and this invisibility brings insignificance to a lot of mathematics teachers; as a result, the learning and programme design hard works remain non-existent (Joseph, 2017). The mediations that are introduced are commonly single focussed and assume that all female students have the same needs. The intervention that can offer a promise for Black girls is an intersectional one that would not only focus on the specific learning needs for perseverance in mathematics (Joseph, Hailu, & Boston, 2017), but would also focus on issues of oppression, power, and social justice for females (Collins & Bilge, 2016).

Also, the low expectations and overall assumptions of teachers about Black female students in society hinder the opportunity for Black girls to acquire knowledge in mathematics classrooms (Rist, 2000). Most teachers have low expectations of low-income Black girls in the classroom, who are seen as having partial knowledge and bring social challenges to the learning surroundings (Joseph, 2017). The importance of mathematics and early confidence of Black girls often fails to transform when it comes to communication with their mathematics teachers. There are positive and negative effects on the mathematics achievement of Black girls in terms of personal interaction with their teachers (Battey & Leyva, 2013). There is also a societal and deep-seated historical myth that mathematics and Black girls are not compatible (Gholson, 2016; Joseph, 2016). Adding to the negative stereotypes that can lead to dis-identification with the discipline of mathematics, Black female students often lack access to excellence in mathematics teaching and learning, and to mathematics courses in schools that are situated in the communities (Joseph, 2017).

In addition, research studies on gender and mathematics have pointed to the presence of negative stereotypes in society that have an emotional impact on the science and mathematics performance of girls by undermining their self-assurance (Leder, 2015; Lader, 2019). Even if, as children, girls and boys are seen as having equal abilities in mathematics, they view grownup men as being better than grownup women at mathematics (Steele, 2003). Similar trends to label mathematics as a male domain have been shown to occur between teachers and parents. For example, parents tend to have more confidence in their boys' mathematical ability than in their girls'. Parents perceive mathematics as a more boyish or mannish field and usually buy mathematics-related products for their boy child rather than their girl child (Bleeker & Jacobs, 2004). These messages start with people who are very influential in our lives, such as teachers and parents and are then picked up and extended by friends (Barnett & Rivers, 2004), and are strengthened by media including television, radios, magazines and textbooks that are used in schools.

Children's thoughts about the meaning of their gender in relation to their intellectual capacity are formed before they have even turned six years of age (Makunga, 2017). One of the dangerous and pervasive ideas is that only boys are good at mathematics and science. Popular media only makes the problem worse. Many girls barely see adult females doing jobs that involve mathematics, science, and technology on television programmes (Long, Boiarsky, & Thayer, 2001). These early myths may result in young girls developing a fear for mathematics and science subjects during the course of their schooling lives. As a result, this eventually restricts their career ambitions. They develop a fear to enter into mathematics fields. McSheffrey (1992) a college mathematics teacher, attended a workshop as an observer to find out why there were so few female students taking senior-level science and mathematics courses. In the workshop, she discovered that many female students felt uneasy and troubled about mathematics and experienced mathematics anxiety.

Gender equality in mathematics and science education and occupations is needed not only because women's education in the field of mathematics and science would provide access to a greater number of extremely skilled employees, thereby

meeting the industrial and scientific needs of the economy, but also that the society can profit from the information and understanding that females bring to the way in which technology and science are used (Shepherd, 2017).

2.5 CULTURE AND MATHEMATICS

Many female learners may have no interest in studying mathematics beyond primary and secondary school for various reasons. One of these reasons is the practice of tradition or culture. A number of cultures and African communities do not have a culture of professional women (Fernandez, 2007). Women are strongly expected to follow their cultural roles of mother and wife. Women have an extra burden to take care of the home and accomplish the responsibilities (Dasgupta, 2013; Friedemann & Buckwalter, 2014).

I am a Pedi woman. If I was married, my in-laws would undoubtedly find it difficult to understand that I am not able to attend to my traditional roles because I have a thesis to write. Even now many people, especially married people, tell me that I should finish my studies before getting married because I will not have time to study and follow my passion when I am a wife. I will have to take care of my husband and children, so it is best that I study and finish before getting married. The belief that women have the inherent capacity as carers and nurturers rather than taking on the challenge of learning a difficult subject is another social taboo. Therefore, the issues of culture are more challenging in teaching and learning mathematics than boys and girls receiving equal opportunity in schools.

One of the stories in an article, "Trapped in-between - A narrative exploration of race, gender and class" by He and Phillion (2001) is a case study of a Chinese woman who lost her husband because of cultural expectations. In the Chinese culture, a woman is expected to be a good mother to her children and a good wife to her husband. As a wife, the woman was expected to put her family's need before herself and her career, and she had a very happy family until she decided to pursue her career in Canada. What happened after that? Her husband thought she was not good enough for him and so he found another woman. This is an example of how culture, marriage and family impact on female's careers (Fernandez, 2007). When women follow their dreams or careers, their personal

packages are always with them. This is an extra layer of difficulty and a discouraging burden for women.

In a research study by Mathema and Bista (2006) there is a strong connection between the mathematics performance of female students and culture. The findings in a recent study showed that female students were getting lower marks in mathematics than males. When comparing the mathematics pass rates of 2017 in South Africa, it was found that at least 57% of male students passed mathematics compared with 46.4% of females (Govender, 2017). The main reason for this difference has been attributed to biased and differential treatment that girls received both at home and at school because of cultural practices. The study also found that many families do not offer opportunities at home that are necessary for girls to perform well in their academics, as they must spend a lot of time at home doing house chores (Mathema & Bista, 2006). In other countries, for example, Nepal, there is a tendency for the majority of parents to enrol their male children to study in independent boarding schools and to enrol their female children in government schools. This favouritism is pervasive in rural Nepal particularly where private schools are far from home.

Patriarchy is, therefore, a common worldwide factor that holds females back, especially Black females. In many African cultures, there is a persistent idea that women “belong in the kitchen” and they are expected to be submissive as a way of showing respect for men (Makunga, 2017).

2.6 ETHNOMATHEMATICS EDUCATION

The term ethnomathematics is used to express the connection between mathematics and culture (D'Ambrosio, 2001). Many teachers may not be acquainted with the term ethnomathematics, however, a simple understanding of it allows educators to expand their mathematical views and more successfully instruct their learners. Educators and society in general do not commonly say that there is a relationship between mathematics and culture. This is because they may not understand how culture relates to children and their learning (D'Ambrosio, 2001).

Ethnomathematics may be defined as a way in which individuals from a specific cultural group make use of mathematical concepts and ideas to deal with relational, quantitative and spatial aspects of their lives (Rosa & Orey, 2011). This viewpoint of mathematics affirms and validates all the mathematical experiences of people, as it shows that mathematical thinking is inborn to their lives. Orey (2000) gives additional confirmation of this declaration. He states that the prototype that different cultures work within develops out of unique interactions between their environment, culture and language. In this setting, D'Ambrosio (2006) maintained that from an ethnomathematical standpoint, mathematical thinking evolves in diverse cultures in agreement with mutual problems that are faced in a cultural setting.

Since there are similar types of problems in diverse cultures, the kinds of methods, theories and solutions that are developed may vary from culture to culture. Therefore, what is perceived as a problem and a solution in one culture may have no meaning at all in another (Rosa & Orey, 2011). The mission of the ethnomathematics programme is to accept that there are various ways of doing mathematics, taking into consideration the assumption that academic knowledge of mathematics is developed by diverse sectors of society (D'Ambrosio, 2001).

Mathematics is recognized in ethnic activities in traditional and non-traditional societies (Rosa & Orey, 2007). This means that ethnomathematics speaks of the concepts of mathematics that are embedded in cultural practices and identifies that all people and all cultures grow unique techniques and cultured explanations to understand and change their own realities. It also identifies that the methods of these cultures that are accumulated, are engaged in a natural, dynamic, and constant process of development and growth (Orey, 2000). Ethnomathematics has come to mean the study of how individuals within different cultures develop methods to understand and explain their own world in response to endeavours, struggles, and problems of human survival (D'Ambrosio, 2001). This comprises material needs along with spirituality and art by using the development of cultural objects, bits and pieces that are created by members of a particular cultural group that naturally give traditional signs about the culture of its maker and users. This perspective provides a significant opportunity for teachers to connect

present events and the importance of these objects in the setting of ethnomathematics, culture and history (Rosa & Orey, 2008).

In contrast, mathematical learning has always been linked with the process of schooling, that is to say, it was thought that mathematical skills and ideas were acquired only when people went to school (Rosa & Orey, 2008). However, analysing the knowledge of mathematics of learners has led researchers and teachers to conclude that knowledge of mathematics is attained outside the designed arrangements of mathematics learning, such as schools (Bandeira & Lucena, 2004). From this standpoint, concepts of mathematics that are applied in distinctive sociocultural backgrounds denote the use of mathematical processes and ideas attained outside of schools and the acquisition of mathematical skills in places other than schools. Dossey (1992) argues that knowledge of mathematics arises from social relations in which relevant facts, ideas, principles, concepts and skills are gained as a result of cultural background.

Moreover, ethnomathematics presents the concepts of mathematics of the curriculum so that these concepts relate to the culture and everyday experiences of learners, in that way improving their skills to elaborate meaningful connections and making their understanding of mathematics deeper (Rosa & Orey, 2011). Zazkis and Liljedahl (2009) indicate that we can include culture in teaching and learning mathematics by making use of storytelling. Storytelling is part of everyone's culture. These authors state that stories in mathematics set an environment of emotions, imagination and thinking (Zazkis & Liljedahl, 2009). They make students enjoy mathematics more. Friday (2014) admits that becoming a storyteller takes effort and inclination but that the effort is worth it. If the community's culture is to enter the schools' culture, then its stories must also come and be an acknowledged form of making meaning.

The guidelines of the National Council of Teachers of Mathematics (NCTM) emphasise how significant it is to build a connection between the personal lives of learners and their cultures (NCTM, 1991). Rosa and Orey (2008) agree with this approach by confirming that when cultural or practically-based problems are looked at in a proper social context, the practical mathematics of social groups are

important because they reveal themes that are deeply connected to the everyday lives of the learners.

A curriculum of mathematics that is culturally relevant should centre on the role of mathematics in the context of social culture that involves the concepts and ideas connected with ethnomathematics, by making use of ethnomathematical views for solving problems that are contextualised (Rosa & Orey, 2008). This kind of mathematics curriculum looks at the cultural congruence between the school and the community of learners, and shows the teachers' respect for the cultural experiences of their learners. Teachers need to understand what amounts to knowledge in mathematics as well as how knowledge relates to the values and norms of different cultures. Having to incorporate different cultures in the classrooms needs an outline, so teachers can make clear informative decisions. This may help them to understand how their cultural prejudices impact on their judgments about the performance and abilities of learners to learn mathematics (Rosa & Orey, 2011).

For a long time, mathematics was taught as a culturally free subject in the schools and by all accounts, it involved learning universally accepted concepts, facts and content (Joseph, 2000). This implies that the academic or Western mathematics comprises a body of knowledge of axioms, theorems, algorithms and facts. How teachers view mathematics is passed on to the learners in their instruction, and this fact helps in shaping how learners view the nature of mathematics. It does not make sense to regard learning mathematics as culture-free and abstract because the process of learning mathematics cannot be free of societal influence. Nasir and Cobb (2007) contend that it is worth noting that, to contextualise mathematics has been defined as the mathematical practical identification developed in various cultural groups. In this viewpoint, if we say mathematics is a cultural concept, then it is a product of cultural developments. Claiming mathematics as a cultural concept opposes the claim that modern mathematics is objective, universal and culturally neutral (Rios, 2000).

We cannot separate the learning and classroom environment from the communities in which they are embedded. Rather, we might consider classrooms

as the environments that facilitate educational practices, which are developed through the use of an ethnomathematical approach. A hypothesis by Rosa (2010) states that low achievement in mathematics is as a result of the lack of cultural consonance in the school's mathematics curriculum. Including aspects of culture in the mathematics curriculum will have longterm benefits for learners who are doing mathematics, that is, aspects of culture add to accepting mathematics as part of day-to-day life, increasing the capacity to make meaningful relations, and expanding the understanding of mathematics (Rosa & Orey, 2011).

According to Chieus (2004), the instructional work towards an ethnomathematics viewpoint enables a far-reaching examination of the school context in which instructional practices go beyond the classroom environment since these practices embrace learners' sociocultural context. Damazio (2004) agrees with this viewpoint by proposing that instructional components that are essential for the development of the mathematics curriculum are instituted in the community of the school. This implies that the ethnomathematics field offers some potential for educational initiatives that help in reaching this goal.

The approaches of ethnomathematics to the curriculum of mathematics are aimed at making school mathematics more meaningful and relevant for learners and promoting their quality of education as a whole (Zhang & Zhang, 2010). In this setting, implementing the view of ethnomathematics in the school curriculum assists in developing the social, intellectual, political and emotional learning of learners by using their unique cultural referents to inform their knowledge, skills, and attitudes (Rosa & Orey, 2011).

There needs to be a change in mathematical instruction in order to support on-going and continuous change in the demographics of learners in the mathematics classroom. Some researchers have established a theory of culturally relevant pedagogy that looks at the process of teaching and learning within a critical paradigm and through open links between the subject matter of the school and learners (Gay, 2000). In this point of view, it is essential to incorporate a curriculum that is culturally relevant in the present mathematics curriculum. This viewpoint is a crucial element of culture that is relevant to education, as it suggests

that teachers contextualise the learning of mathematics by connecting mathematical content to the culture and daily life experiences of learners (Torres-Velasquez & Lobo, 2004).

Mathematics, as part of the curriculum of the school, must value and strengthen learners' knowledge of culture rather than negate and ignore it (Rogoff, 2003). A curriculum that is culturally relevant should fully incorporate learners' cultural mathematics knowledge through ethnomathematics. This curriculum of mathematics must be grounded in an approach that is constructive to learning and strive to change the ways in which teachers of mathematics construct their learning environment (Rosa & Orey, 2011).

The ethnomathematical curriculum takes the culture of learners and openly uses it to incorporate outside experiences into the curriculum of conventional mathematics (Lipka, 2002). In such a learning environment, learners can build on what they already know, as well as on the experiences they have from their cultural environments (González, Moll, & Amanti, 2005). These experiences are then used to understand how ideas of mathematics are developed, how they are constructed into the systems, and how they are expressed and practised in numerous ways within the culture.

This knowledge of mathematics relates to conventional mathematics in such a way that the underlying ideas of mathematics are completely understood and the values of power of conventional methods are cherished. In countries where there is a diverse population, such as Brazil, teachers have called for the acknowledgement of the fact that mathematics is a cultural product and things such as the ethnicity of learners can factor in how it is learnt (Presmeg, 1998).

Numerous approaches have been recommended for differentiating mathematics education that has been active in refining the achievements of subgroups in mathematics (Bal, 2016). Various studies have shown that learners who learn mathematics through ethnomathematical programmes perform better on standardised tests (Lipka, 2002). Also, fastening values of culture as a means of transmitting the contents of mathematics helps to emphasise the significance of

mathematics to the lives of learners, which in turn, makes the lesson more exciting and fun. Day-to-day presentation also stimulates learners' enthusiasm and interest to work towards finding a solution to the problem.

2.7 THEORETICAL FRAMEWORK

This section introduces the theoretical framework that underpins my study. A theory is a model for understanding and observation, which forms both what we see and how we see it (Reeves, Albert, Kuper, & Hodges, 2008). By grounding autoethnography in theory the researcher obtains a broad abstract understanding of things that cannot be held down, such as why people behave in certain ways or why there are few Black females in mathematics education. Theory also provides various lenses through which to look at complex problems and societal issues (Reeves et al., 2008). We can use a theoretical lens to design the study and develop instruments to generate data in qualitative research such as interviews or observations (Corbin & Strauss, 2008). Theories are formulated in order to predict, explain, and understand phenomena, and also to extend and challenge the knowledge that already exists within the boundaries of critical bounding expectations (White & Klein, 2002).

Through theorising, the autobiographical detail transcends beyond the story and obtains deep philosophical and sociological assumptions. Hence, the autobiographical detail of my story becomes rich abstract data, which can be interpreted and analysed through a theoretical lens. Through theory, the autoethnographer obtains a better grasp of the lived experiences depicted in the story. Levinson (2011) describes this process of looking at a story as being able to lift the veil to see the dots. In this section, I explicate the theories of feminism and Black feminism.

2.7.1 Feminism

My study is strongly influenced by my own assumptions and lived experiences as a Black female in South Africa. Therefore, feminist theory was deemed the most relevant theory for the study. Feminist theory is one of the theories within sociology that distinguishes how its inventors change their assumptions, logical lens, and contemporary focus away from the experience and viewpoints of males

(Crossman, 2017). Feminism is very comprehensive, consisting of a wide range of philosophical standpoints. In this study, I set boundaries within two feminist viewpoints. These are Black feminism and African feminism. Feminism focuses on segregation and unfairness on the basis of gender roles, economic and structural inequality, oppression, and objectification among others. Feminist theory views the social world in a way that illuminates the forces that create and support injustice, oppression and discrimination, and as a result, encourages the recreation of equality and fairness (Crossman, 2017). The main aim of feminism in education is to eliminate difficulties that prevent girls from reaching their full potential, whether such difficulties are found in unequal labour practice or at schools (Arnot, 2007).

When the modern African Diaspora was created over four hundred years ago, females were shoved all over the African continent and became a Diaspora, due to the forces linked with wars, poverty, political instability, militarisation, colonial expansion and enslavement, wars and militarisation (Kuumba, 2003). There is a need for feminism in African societies. Feminism in Africa aims to upset and overcome the existing medium of power and control; as a result, it transforms formations and gender relationships in African societies and improves the location of African women (Arndt, 2002). The global African feminisms contest the several discriminations that are faced by African women and confront patriarchy within the national emancipation movements, from which many African feminists around the world emerged (Kuumba, 2003).

2.7.2 Black feminism

Black feminists got involved in specific feminist oratory during the 19th century; however, the term Black feminism was invented in the 1970s. These Black feminists made the case that politically and socially Black females have to contend with the idea of the double mind, which refers to both being a female and being Black (Davis & Brown, 2017). The theory of Black feminism is considered by some very particular philosophies, as it links to the justice movement for Black females. The Black feminist's perspective is one that must hold and involve the intersectionality of women; that must have a social construct that is sieved through a double lens; and that is marginalised from gender and race perceptions (Davis & Brown, 2017).

The truth that Black feminists face is that when White feminists talk about the movement, they do not talk about the fact that they are more likely to do extremely well within social, political and economic spaces because of their privileges (Breines, 2007). White feminism is essentially ignorant as to how White women may act in ways that silence other marginalised community due to the blinders that come with White privilege. In the past, Black females were not seen as worthy to be called women; they were seen as a thing or an animal. White feminists only want to talk about patriarchy, sexism or the positive aspects of history (Breines, 2007). The experiences of Black women are uncared for by the feminist movement, erasing their past and opposing their existence (Hooks, 2014).

Black feminism gives us an opportunity to see and understand that our distinctiveness exposes us to various types of oppression. Hence, emancipation for people of colour can only be realised by lifting up the experiences and voices of the silenced and helpless groups within Black populations (Roth, 2003). It is in taking a Black feminist theory that one will see and humanise Black bodies that have been made inferior. Therefore, I made use of it to communicate my personal gender and racialized experiences in an unequal society and education.

Clearly, when we talk about the rights, sufferings, and equalities of women, we can automatically denote our explanation to the segregation of Black women. Even though feminism appealed in its aims and symbols to the equality of all women regardless of their social and cultural belonging, it did not give significance to the challenges faced by Black women. In practice, the focus of feminism was on the needs of White females in America and Britain while posturing as a movement for the freedom of women generally. One well-known Black feminist, Patricia Collins, deliberated that feminism did not bring any rights to Black women whatsoever.

Black females were separated from taking part in any political, economic and social events prepared by feminist organizations, which were organised at that time by White females. In one way or another, all women from all areas were murdered and sexually abused and they all suffered, but no one grieved in a painful and violent way like Black women. Black feminists conveyed their own

marginalisation and endowed Black awareness in society, as a result of not being involved in the White feminists' discourses (Moya, 2018). Due to various Black females' experiences, it is vital for Collins to go and give her special accounts about the oppression of Black women.

Black feminist theory in America was first used by Black American women to make meaning of the ways in which patriarchy and White supremacy worked together to advise the specific experiences of imprisoned Black women (James, 2000). Black feminism supporters contested that Black females were placed in structures of power in essentially diverse ways from White females. The aim of Black feminism is to permit Black females to engage with new ways of thinking that focuses on how sexism and race interact to build inequities and social issues of Black women that stems from jointly constructed structures of oppression. The most important aspect of feminism is intersectionality.

Black feminist theory cannot challenge class oppression, gender and race without giving African women authority. People who are oppressed struggle by determining their new character, describing their actuality, finding themselves as subjects, telling their stories, and naming their history (Amoah, 1997). The practice of narrative or telling stories is deeply rooted in the culture of Black people. It is a culture based on the steadiness of wisdom, and its purpose is to proclaim the voice of the marginalised. If theory is defined to be more than the narratives of experiences, it can be argued that Black feminist theory is revealed in the storytelling of Black women. Black females are shaped and informed by their own experiences as well as the experiences of those that came before them and those around them. If the effect of one's own experiences on one's creation or visualisation of the world around them is approved, then the theory of Black feminism is not just a method for inspecting, making, or even analysing social reality; rather, it is a way of life and living.

2.8 CONCLUSION

To summarise this chapter, mathematics may function as a tool for classifying and examining critical structures of society, which may be universal and having to do with the local background of students (Skovsmose & Nielsen, 1996). This chapter

began by giving an explanation as well as the purpose of the literature review. The focus in chapter 2 was on the literature related to mathematics education, gender and race. The literature review in this chapter focused on the power of mathematics, race and mathematics, gender and mathematics, culture and mathematics, and ethnomathematics. This chapter concludes with a discussion of the theoretical framework, which located my study. I used feminism and Black feminism as my theory and obtained a better understanding of my lived experiences depicted in my narrative. The next chapter will present a discussion of the research design and methodology.

3. CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In chapter 2, I discussed the conceptual and theoretical framework that underpins my study. An exploration of the existing scholarship on my topic provided me with a better understanding of my topic and pointed out the gaps in the research field. In this chapter, I discuss the research design and methodology of this study. I also discuss the methods I used to craft, interpret and analyse my narrative, as well as how I ensured the trustworthiness and ethical considerations of my research study.

3.2 RESEARCH DESIGN

The research design can be understood as the main plan or logic of a research study that explains how the study is to be carried out (Van Wyk, 2012). The research design can be viewed as an actualisation of logic in a set of techniques that enhances the reliability of data for a specific research problem (Thomas, 2010). It provides the researcher with directions from the basic logical assumptions to the research strategy and data collection.

According to Van Wyk (2012), the research design is the complete and systematic plan that links the abstract research problem to the relevant experimental research. In other words, the research design enunciates the type of data that is needed, the process to be used for data collection and analysis, and how all these processes will answer the research question. Mulia (2014:27) defines the research design as “a blueprint or detailed plan of how a research study is to be completed; operating variables for measurements, selecting a sample, collecting data and analysing the results of interest to the study, and testing the hypothesis.” His definition is supported by Creswell (2013), who postulates that the research design is the entire process of research which includes the conceptualisation of the research problem and question, data collection, analysis and interpretation of data, and finally, the compilation of the report. Hence, the research design provides the structure of the research report in terms of the theoretical framework, methodology and the data collection instruments.

3.3 RESEARCH APPROACH

The research approach that was used in this study was qualitative. Qualitative research relies on words and not numeric data (Nieuwenhuis, 2016). Qualitative research is naturalistic, which means that it takes place in a real-life situation where there is an interaction (Creswell, 2013; Denzin & Lincoln, 2005). A qualitative study is useful when you want to obtain ethnically exact information about opinions, behaviours, values and social backgrounds of particular populations. An advantage of qualitative research is that it stimulates individuals' experiences, meaning that an in-depth image can be developed about why people act in certain ways and how they feel about these actions (Kelle, 2006). I used a qualitative study to gain insight and explore the richness, depth and difficulty inherent in the topic of my study. By doing qualitative research, I was able to take an in-depth look at my lived experiences and how the society in which I lived dealt with race and gender.

Another advantage of a qualitative approach is that the results of the research are descriptive rather than predictive (Nieuwenhuis, 2016). Hence, my study involved a description of my own lived experiences. In addition, a qualitative research study is a logical scientific examination that aims to build a holistic, mostly descriptive, narrative to inform the understanding of the researcher about the cultural and social phenomenon (Astalin, 2013). Through a qualitative approach I, as the researcher, became central to the research. In summary, qualitative research allowed me to provide a thick narrative description of my behaviour within a specific context.

3.4 RESEARCH PARADIGM

The research paradigm is based on the researcher's philosophical assumptions. According to Alharthi and Rehman (2016), the research paradigm naturally reveals how we perceive the real world (ontology) around us and what we know about the world (epistemology). Therefore, the research paradigm informs how we construct new knowledge about ourselves and society. In an interpretive research paradigm, reality can be explored and constructed through human interactions and meaningful actions (Rehman & Alharthi, 2016). My study adopts an interpretive paradigm, which aims to understand people (Babbie & Mouton, 2008). It focuses

on the exploration of the complexity of myself as a child and a learner and how I experienced mathematics education. The research paradigm of my study is interpretive because through an autoethnography I attempt to interpret my lived experiences as a Black female within mathematics education. The use of the interpretive paradigm in my study is supported by Rubin and Babbie (2010) who state that an interpretive researcher believes that reality is subjective because it is shaped by the participant's perceptions as well as the researcher's aims and values. Knowledge is personally experienced rather than acquired from the outside.

3.5 AUTOETHNOGRAPHY AS A RESEARCH METHODOLOGY

The research methodology is underpinned by the research design. It describes in detail how data will be collected and analysed (Babbie & Mouton, 2008) and highlights the advantages and limitations of the research process. I have selected self-study as a research methodology. The choice of my method of research was informed by the reality of the world (ontology) and how I wanted to construct new knowledge about it (epistemology). Self-study is not only writing about the self, but it draws from the historical, cultural and political context wherein the self is situated (Lewis, 2019). Autoethnography is a form of self-study in which the researcher writes not only autobiographically but also ethnographically. A definition of autoethnography that struck my eyes is that it is “an approach to research and writing that seeks to describe and systematically analyse (*graphy*) personal experience (*auto*) in order to understand cultural experience (*ethno*)” (Ellis, Adams and Bochner (2011:1).

The term autoethnography originated in the 1970s and it was used to describe studies in which cultural members gave an understanding of their own cultures. It is a research methodology that describes and systematically analyses personal lived experiences and links those experiences to the culture and society in which it took place (Ellis, Adams, & Bochner, 2011). Within an autoethnography, the researcher makes use of writing about self and society as well as reflecting deeply to discover subjective and personal experiences and to link an autobiographical story to broader political, cultural and social values, and understanding (Ellis,

2004). Adams, Ellis, and Holman Jones (2015) postulate that autoethnography values and recognises the relationship of the researcher with others.

There are two types of autoethnography, namely analytic autoethnography, which focuses on the development of academic explanations of wider social phenomena, and evocative autoethnography, which focuses on the narrative performance that arouses emotional responses and excavates conversations (Ellingson & Ellis, 2008). My study uses evocative autoethnography. Evocative autoethnography is not only self-conscious and “self-obsessed” (Campbell, 2017:1) but also evokes feelings and action from the reader. Through the exposure of personal experiences and emotions, the reader is brought into the life and experiences of the ethnographer through narrative and storytelling (Campbell, 2017). The personal experiences of the autoethnographer become powerful and culturally important (Ellis & Bochner, 2011).

Through autoethnographic writing, the researcher transcribes past experiences to bring together a text that uses characteristics of storytelling strategies, such as dramatic tension, character development, and narrative voice, to create an evocative picture of the cultural experience and to present to the readers a logic of how being present in the experience feels (Ellis, 2004). Autoethnography is about storytelling. In this study, my story is about my personal lived experiences within mathematics education as a Black female in South Africa. Through an autoethnography, writers communicate their self-study as a short story, poem, play, novel, performance piece, or other investigational text as well as through characterisations, emotions, plots, introspection shown in conversations, extracts, real actions, and self-consciousness (Ellis, 2004).

In many cases, autoethnographers write about critical moments or epiphanies in their lives, which are perceived to have importantly impacted an individual’s life, time of existential predicaments, and required a person to deal with their lived experiences (Zaner, 2004). Writers selectively and retrospectively write about epiphanies that come from being part of a certain culture or by having a certain cultural identity. Maso (2001) posits that where the researcher conducts an autoethnography he or she studies common beliefs and values, culture’s relational

practices, and common experiences, with the aim of helping the outsiders and insiders to have a better understanding of the culture. The researcher seeks to produce evocative and aesthetic thick narrative of interpersonal and personal experiences when writing autoethnographies.

When I was writing about myself, or doing autoethnography, I mostly brought back memories in order to reflect on past experiences; had conversations with others about the past, and studied texts such as personal journals, photographs, school report cards, and other archives related to my life events (Ponsoneau-Conway, Adams, & Bolen, 2017). In my study, I informed the audience about features of my cultural life that may not be known by other researchers. People who have limited or indirect experience with cultural problems or institutional oppressions, such as discrimination or racism, cannot talk about these matters in the same way as an individual who has had a direct experience about these topics. This does not suggest that a person who has had a direct experience with these matters can articulate more accurate or truthful knowledge compared to those who have limited experience, but rather that, as writers, we can tell our stories in different ways compared to how others may be able to tell them.

3.6 RESEARCH INSTRUMENTS THAT I USED TO CRAFT MY AUTOETHNOGRAPHY

In this section of my research, I discuss the instruments that I used to gather data to write my narrative. As the researcher in this autoethnography, I am the primary apparatus for obtaining data and analysis. I used the following methods to craft my narrative: archival visits and records, memory work, critical conversations with others, and journals. I also highlight the strengths and weaknesses of each method.

3.6.1 Self-interview and memory work

Radvansky (2017:1) defines memory as “the location where information is kept, as in a storehouse, or memory store.” It is the conceptual process that is used to obtain, store, or recover all types of data. Memory work is a method of engaging with the past, which has both recent and past elements (Copeland & Radvansky, 2004). Chang (2008) defines personal memory as a building block of an

autoethnography because the past gives a background to the current self, and memory opens the door to the richness of what has gone before.

According to Conway (2001), autobiographical data, from which certain memories can be created can be thought of as the database of the self. It is a database that holds and restraints (restrains?) what the self is, as well as what it can turn out to be. Due to this strong connection to the self, personal memories are one of the primary sources of identity and they give a vital psychological connection from the past of the self, which is rooted in society. For the purpose of this research project, I have used my personal memory to select a list of major events or experiences of my past life and linked them to my present self.

One of the advantages that I had through using my memory as a method of collecting data is that, as an autoethnographer, I did not only have the privilege of accessing my past experiences and personal interpretations of those experiences but also had first-hand discernment of what was relevant to my study. I used my personal memory to select events that had led to significant self-discovery, as well as to recall and retrieve past experiences in my life of mathematics. My memory brought back past experiences that were exciting, painful and emotional. I needed my memory to recall my past experiences that assisted me in crafting my narrative.

3.6.2 Archival visits and records

Archival data are records, documents, and other sources of the past (Mohr & Ventresca, 2002). They exist to keep past materials that are important and make them available to be used in the future. These include photographs, report cards, newspapers and letters. My archival visits included photographs of me growing up and pictures of my family and relatives. I collected and re-examined documents such as report cards, birth certificates, as well as all the awards I received at primary and secondary school. I used report cards to investigate how I performed in mathematics during my school years. Seeing my mathematics marks from my report cards reminded me of the opportunities I had, as well as the proud moments I celebrated with my family and friends.

In addition, I collected pictures of my primary and secondary school mathematics classes in order to recall events I had experienced in the past (Radvansky, 2017). Pictures helped me to remember moments that have long passed, such as sports events and award ceremonies. They also reminded me of my friends and my favourite teachers. My matric certificate reminded me of the excitement and the achievement, especially of my B-symbol in mathematics and meeting the requirements to study a degree of my choice.

One of the advantages of the archival method is that the data is already collected (Dooley, 2015). This has helped me to save money, time and effort during the research process. The disadvantage of archival method is that the format of the data may not be easy to use to answer the research question. All these materials from the archive have helped me in studying the social phenomena of the past and the behavioural changes over time.

3.6.3 Reflective journal

While I was collecting data for my story, I used a reflective journal to record conversations I had with my parents, friends and teachers. I recorded my feelings and emotions. A journal taught me to communicate my thoughts (Hyatt, 2012). In it, I recorded dates of when the events occurred and how they occurred, as well as the people who were present at the time.

3.6.4 Critical conversations with co-constructors of my autoethnography

Throughout my study, I was conscious of the fact that writing about myself could be regarded as narcissistic and having a narrow vision (Luvaas, 2017). Hence, I had critical conversations with my family members, friends and teachers to complement my memory. In this manner they became co-constructors of my narrative. They could also fill gaps in my memory about myself by adding to my story (Giorgio, 2013). I could also compare my experiences with similar experiences that my family, peers and colleagues had in their lives.

I had critical conversations with my mother trying to find out why she decided to teach me mathematics from a very young age. During my conversations with her, I was able to recall moments when we practised mathematics concepts together. My mom was the one helping me with my homework and she had her own way of

teaching mathematics. With these conversations, I was able to remember some of those strategies and that helped me to achieve success in mathematics. I also visited the schools I attended and the few teachers who had an impact on my mathematical success. I used conversation to find out why they decided to teach mathematics rather than other subjects. During the conversations, I figured out why they loved mathematics, and why some of them had a belief that mathematics is a subject for everyone.

My father loves mathematics passionately. I also had a conversation with him to find out what he did to succeed in mathematics. While talking to him, I found out why he thought that mathematics was only for gifted males and not females. In addition, I had conversations with a few of my peers with whom I practised mathematics. They reminded me of different events during our school years. Through these conversations, I was able to reflect on my past and recall what we did to better our understanding of mathematics. In using critical conversations, I have not only observed what was said, but I also observed the emotional expressions, gestures, and physical actions that took place during the conversations.

3.7 VERISIMILITUDE

Verisimilitude is a central criterion of validity for a self-study. Clandinin and Connelly (2000) refer to verisimilitude as an important principle to judge the worth of narrative inquiry. Since narrative analyses look at the interpretation of personal truths, it is vital that these readings meet the principle of verisimilitude. For my autoethnography, I have subscribed to verisimilitude as a form of quality check. To achieve trustworthiness I asked my parents, peers and teachers to write letters to confirm that what I said in my story was true.

3.8 ETHICAL CONSIDERATIONS

Before the commencement of the study, I applied for ethical clearance to involve the co-constructors of my autoethnography in my study. The ethical clearance was obtained from the Faculty of Education of the University of Pretoria. To ensure that the rights, dignity and confidentiality of my contributors were protected, identifying information was not made available to anyone who was not directly involved in the

study. I informed the co-constructors of my autoethnography that their participation in the study was voluntary and that they were free to withdraw from the study at any time or at any stage without any unfavourable consequences. I was aware that the contributors in my study were closely related to me. They were given an assurance that if they did not participate, they would not be discussed with anybody and also that our relationship would not be affected.

3.9 CONCLUSION

In this chapter, I have outlined and explained the research design and research methodology used in my study. I have discussed and justified the process of my research because I wanted to indicate the route I followed to answer my research questions. A qualitative research approach was chosen for the study and an interpretive paradigm was employed to guide the research action (Mittwede, 2012). The research methodology used for my study was autoethnography, through which I recounted my lived experiences and connected them to those of the society and culture in which they occurred. Furthermore, data were collected using memory, archival records and visits, reflective journals, and critical conversations with co-constructors of my autoethnography to achieve verisimilitude.

4. CHAPTER 4: MY NARRATIVE

4.1 STORY ONE – LIFE BEFORE SCHOOL



Picture 1: Picture of Tembisa

My name is Dorcus Sibongile Mlangeni. I am the firstborn child of Oupa China Malatjie, a Pedi-speaking African man, and Nomvula Maureen Mlangeni, a Zulu-speaking African woman. That made me a Pedi girl because my father was Pedi. However, I use my mother's surname, which is Mlangeni, instead of my father's surname, which is Malatjie, because my parents did not marry each other. In African culture, when a man impregnates a woman out of wedlock, the child belongs to the mother's side and will use the mother's surname, culture and beliefs. However, if the father wants his child to bear his surname, then he must pay *lobola*¹ for the child. Only then will the child belong to the father's side of the family.

I was born in the year 1991, three years before democracy in South Africa, in Ivory Park, an informal settlement that is part of Tembisa, a Black township situated in

¹**Lobola** is an African practice in which the forthcoming groom's family make payment, either in heads of cattles or cash, to the forthcoming bride's parent for customary marriage.

the northern region of the City of Johannesburg, Gauteng Province, South Africa. Tembisa (*aka Mambisa*), *Kasi lama Kasi!* Sixteen thirty-two! A place of hope. A place where Black South Africans were able to maintain the principles of ubuntu and community. Tembisa (meaning hope) is the Nguni name for a group of Southern African indigenous people consisting of the Swati, Xhosa and Zulu nations. When Tembisa was established, it became a symbol of hope for those who were suddenly homeless.



Picture 2: Ivory Park Section (A place I grew up in)

Tembisa, once farmland, was the second-largest settlement for Black people during the apartheid era. The township was established in 1957 when African people were resettled from Alexandra and other areas in Edenvale, Germiston, Midrand and Kempton Park, places that were declared White in terms of the Group Areas Act of 1950. The Group Areas Act of 1950 formed the foundation of the apartheid policy designed to execute control over property trades and property possession, based on race, across South Africa. Due to the Act, large numbers of Black, Coloured and Indian people were relocated to race-designated areas, separating families and communities.

Tembisa is one of the biggest townships in the Southern hemisphere, with 463 109 people residing in it and having over 60 sections. The majority of people in Tembisa are living below the poverty line, while others have found some ways of bringing about change and improvement over the past years of democracy. A very large number of families in Tembisa live in informal settlements, and over five

hundred people share the same mobile toilets, while children play along the broken sewage pipe where they are in danger of getting sick from germs (Mukwevho, 2013). The area is physically secluded from the stronger trade and industry nodes in the municipal centre, and numerous socio-economic challenges, comprising unemployment, child-headed families, illiteracy, and fruitlessness weigh down the settlement. There are a series of social ills, such as peer pressure, alcohol and drug abuse, drugs, and crime. Tembisa is well known for its crime and violence. Most of the people coming from other places avoid Tembisa because of the crime rate.



Picture 3: Crime in Tembisa – Birch Acres Mall

The picture above was taken in January 2019 at one of the malls in Tembisa. Two people were murdered in cold blood in the course of an argument because some drivers jumped to the front of the queue (Ngwenyama, 2019). In 2018, 7 655 crimes were reported, which included 798 burglaries at residential premises, 311 motor thefts, 656 assaults with the intent to inflict grievous bodily harm, and 97 murder cases (SA Crime Stats, 2018).

Being born in Tembisa, I lived in a one-roomed shack in Ivory Park Section. Eight of us (including my grandmother, my mother, my aunt, four uncles from my mother's side and myself) lived in the shack. This shack was used as a bedroom,

kitchen, sitting room, and bathroom at the same time. There was no water and electricity. We had to travel a distance of five kilometres to draw water.

Growing up in our family of eight, nobody worked except for my grandmother, Thandiwe Mlangeni, who worked as a domestic worker for a White family in the White suburb of Edenvale.



Picture 4: Me and my grandmother (Thandiwe Mlangeni) after graduation

My grandmother was the breadwinner for the family. She was earning peanuts (a very little amount of money). As grandmother, she was the matriarchal figure in the family, since she and my grandfather had divorced. She was the one who took care of us. With the small amount of money that she earned, she was usually able to put a plate of food on the table, although there were days when we did not have food to eat and my grandmother had to ask for food from the neighbours to feed us.

When I was two years of age, my mother also got a job as a domestic worker at Edenvale. She could not take me to a pre-school like other children whose parents could afford it, so she had to take me with her to work. She would say, “I am taking my daughter with me to work because there is no one to look after her.” While she

was working, I sat in an outside room, a very small room that my mother used as her changing room, and played with toys.

4.2 STORY TWO – FIRST MATHEMATICS EXPERIENCES

In a corner of our one-roomed shack, we had a tiny table. That we used for cooking, chopping and dishing out food. This table was also used as a table for study. At this table, I had my first mathematics lesson from my mother. In 1995, I was three years old and about to turn four. I had my first lesson a day after my grandmother's birthday on 11 April. I had returned from playing outside with my pre-school friends, whom I used to learn things from. She overheard me counting and said, "You counted from 1 to 5 but struggled to continue counting to get to number 10." She also said, "I was sitting at the table looking at you counting, and I saw the frustration and disappointment on your face when you could not continue counting to 10. I was saddened. At that moment I decided to teach you mathematics."

She asked me to sit at the table with her in order for her to teach me. I remember she said, "*Nana, woza la uzohlala nam ngizokufundisa ukubala* (Come sit next to me so that I can teach you how to count)." I was so happy to hear her say that because I really wanted to know how to count. I envied my friends who were receiving pre-school education.

My mother then taught me to count from 1 to 10, then from 1 to 20 and 30 until I was able to count from 1 to 50. It took us about two months to learn how to count from 1 to 50. She never skipped a day without teaching me mathematics and other relevant things such as writing my name and surname and memorising my home address. She taught me everything I had to know in mathematics. I enjoyed mathematics from the first day she taught me. "You loved mathematics and enjoyed every lesson I did with you. Your uncles once complained that I should be teaching you how to wash dishes and other house chores because you are a girl." I was surprised and I laughed, because I did not think my uncle believed that women belong in the kitchen. My uncles always used to tell me to study further and work on achieving my dreams. Hence, I was surprised to hear from my mother that they had complained about her teaching me mathematics.

In 1996, when I was five years old, at around 7 p.m. my mother had just finished cooking. After we had eaten and washed the dishes, she removed everything from the table. The previous night she had promised that she would teach me addition of numbers. She said with a very big smile in her face, “*Dodo, kusasa ngizokufundisa u 1+1* (Dodo, tomorrow I am going to teach you 1 + 1).” I asked her, “*Mama, yini i 1+1* (Mom, what is 1 + 1)?” She replied by saying that I would see what 1 + 1 means the following day. She meant that she was going to teach me addition of numbers when she said 1 + 1. She took a book that we always used for mathematics and wrote the following numbers:

$$1 + 1 =$$

$$2 + 2 =$$

$$3 + 3 =$$

$$4 + 4 =$$

$$5 + 5 =$$

I was very excited because I had never this type of calculation before. I did not even understand what one plus one meant but I was happy to do it. I asked my mother what plus meant. She said that I asked too many questions and I should just keep quiet and let her teach me. According to her, by just listening, I would then know the answers to all my questions. At that stage, I knew how to write numbers one to 10 and I understood the number one when I saw it.

She explained what the symbol of equation meant. She pointed at the addition (+) sign and said, “This sign means plus” and she pointed to the equal sign and said, “This is an equal sign.” She then started to teach me how to add numbers by teaching me using my fingers. She made an example by using 2 + 3 to demonstrate. She raised two fingers of one hand and three fingers of the other hand and asked me to do the same. I remember she said I should combine the two fingers of one hand with three fingers of the other hand and count how many fingers we had. I counted five fingers and she explained that 2 + 3 = 5. She did many examples before she would let me work on my own. I was very quick to understand, and it took me less than an hour to understand how to do addition.

After a week and a half of practising addition, my mother started to teach me how to do subtraction. After a while, when I was confident to add and subtract numbers

from one to 10, she gave me more challenging sums to complete. I remember one time she wrote $15 + 10 =$. I could not add the two numbers because I only have 10 fingers. I did not know where I would get the other 15 fingers. I was a bit confused and thought maybe my she gave me a wrong sum. When she noticed that I could not count correctly, she told me to go under the table to find a plastic bag. The bag contained bottle tops. She used those tops to teach me how to add and subtract large numbers. I remember she made me count 50 bottle tops and put them aside. We only used 50 bottle tops during our lessons. She demonstrated to me how to add 15 and 10 using bottle tops. For example, she asked me to count 10 bottle tops and put them aside and count 15 and put it on the other side. Then she said that I should combine them and count how many bottle tops I would get. I counted 25 and wrote it as an answer. She did a few examples to show me how to add and subtract. Then, I was ready to do in on my own.

My mother was there to assist me when I did not know how to do other sums on my own. The first few days when I worked on my own, I made many mistakes, such as miscounting numbers. Once, when my mother gave me a sum of $7 + 8$, I counted six bottle tops instead of seven, and added them to eight bottle tops. My answer was 14 instead of 15. I kept on making similar mistakes until my she got angry and began shouting at me, threatening to beat me for not focussing. My mother was very short-tempered. When she taught me something, she did not want to keep on repeating herself. She would be patient with me for a short while, then she would get angry and give up on me when I did not get it right. When I kept on making mistakes, she looked at me with her unhappy face. It was the first time I saw her frowning when she taught me. She smiled when I was able to understand the concepts and solve problems. She said to me that I had to pay attention to everything that I was doing or else I would fail at school.

The reason that she shouted at me was not that I had written wrong answers, but that she had returned from work frustrated and sad, and complaining about her work conditions and being underpaid. I was under the impression that she was angry and took out her frustration on me. I was scared of her behaviour. She noticed my fear and apologised, then she helped me to do the sums. I was more

confident and wrote the correct answers the second time around and I remember seeing her clapping her hands and hugging me for getting the correct answers.

At the age of five, I started writing my own sums and was able to solve them. I was comfortable with addition and subtraction. This was exciting and I remember being proud of myself because I understood the concepts. My mother said that there was one night that I spent doing mathematics and when my grandmother asked me to go to bed, I refused because I was enjoying mathematics. I spent almost the whole night doing addition and subtraction until I fell asleep at the table and my mother woke me up to go and sleep.

The first thing that I did when I woke up in the morning was to take my mathematics book and write out all the sums that I was going to teach my friends. I had written addition and subtraction of numbers from one to 10. I was so excited that day and went to my mother's brother, Ntokozo, who was 11 years of age at that time. He was babysitting me on that day. I showed him my sums. He did not even pay attention to what I was showing him and just continued playing marbles with his friends. I was a bit disappointed in him for not giving me any attention. I could not wait to teach my friends. I was tired of them teaching me things that they had learned at their pre-school. It was about time I taught them what my mother taught me. I believed that she was better than the teacher who they had at pre-school.

When I taught my friends, they could not understand the sums. They struggled to calculate simple sums like $3 + 4$; $8 + 8$; $4 + 5$. This irritated me and I could not understand why they were finding these simple sums challenging. For me they were simple sums because I was used to calculating big numbers such as $15 + 16$ and so forth. I went home crying because they did not understand these simple calculations, although they were in school. I felt as if they did not want to learn when I taught them. I told one of my friends, Elizabeth (Lizzie), that she was not fair because when they taught me, I was quick to grasp. However, when I taught them, they struggled and seemed to lose interest. My friends found my calculations too difficult. This made me so sad that I did not even want to practise my mathematics that evening and went straight to bed without eating.

I went to school at the age of six. My mother enrolled me at Kanana Primary School in Tembisa.



Picture 5: My first primary school - Kanana Primary School, Tembisa

The school was surrounded by squatter camps². On the first day of school, I woke up very happy and excited. I was finally going to “real” school like my friends. I was excited that I was going to learn more things at school. I took my bottle tops with me to school, although my mother had told me not to take them. I wanted to use them at school and show my teacher how clever I was.

I found no school building. I had expected to see a “real” school building. Instead, we were taught under the trees with no furniture. It did not matter to me because I was just happy that I was finally in school. My school experience turned sour when I realised that I was not doing mathematics with my teachers. Maybe we did have mathematics lessons or maybe we did not, but I cannot remember doing it. Every day I went with my bottle tops with the idea that we would do mathematics, but I never had a chance to use them. I changed my teacher and went to another teacher in the hope that I would learn mathematics.

I realised that the teachers were repeating things that I already knew, because my mother had taught me these skills. I became bored with the work and left the school premises even before the school bell had announced the end of the school

² **Squatter camps** are settlements which consist of shacks that are built with tins, cardboard, wood, and other scrap materials.

day. The school had no fence, so it was easy for me to just walk home without permission of the teacher.

My mother took me out of school and decided that I would restart schooling in the following year. She also earmarked a school that was located closer to our house. Meanwhile she taught me to read in my mother tongue. She used her own grade 12 novels to teach me to read isiZulu. Although she was teaching me to read, she continued with the mathematics lessons. I could do calculations from one to 30. Every night my mother asked me to solve a sum for her. I had almost all the sums correct. My confidence and love for mathematics grew, as I was receiving lessons from her.

My friends in the squatter camp had already started school, which they attended, while I was sitting at home waiting for the following year to restart at a new school. In the afternoons, I sat with them when they were doing their homework. One day, in one of my friend's mathematics books, I saw apples and a plus and minus sign. I was confused and asked what kind of mathematics that was. I could not understand why they were using fruit and pictures and not numbers. My mother never used pictures when she taught me. I only worked with numbers.

I started learning how to do subtraction and addition with pictures from my friend's book that they used at their school. When my friend's mother saw that I was interested in calculations, she gave me a mathematics book with pictures in order for me to practise mathematics on my own. I used the book to practise mathematics at my mother's workplace while I was waiting for her during the day in the small change room at her White employer's house.

4.3 STORY THREE – MY FIRST FORMAL MATHEMATICS LESSONS

I restarted my formal schooling at Phomolong Primary School in 1999. My grade 1 teacher was very good with languages. She taught me how to count in my mother tongue, isiZulu:

Kunye (one)

Kubili (two)

Kutha (three)

Kune (four)

Kuhlano (five)

Isithupha (Six)

Isikhombisa (seven)

Isishiyagalombili (eight)

Isishiyaga lolunye (nine)

Ishumi (ten)

Although I could count in my mother tongue, I did not really enjoy the lessons. I had no challenging calculation problems to solve. The sums that I did at home were more difficult than those I had to do at school. It was only in grade 2 that I started to enjoy my mathematics lessons with my grade 2 teacher.



Picture 6: Grade 2 class at Phomolong Primary School

My teacher had a big smile on her face when she introduced herself to us and said, “Good morning, learners. Welcome to grade 2. I am going to be your class teacher.” These were simple words but the way she said them was remarkable. I felt welcomed and excited to be in her class.

I started to learn the multiplication table. She gave us a chart with multiples of 1, 2, 3, 4, 5 and 6. Within a month, we had already understood these multiples. She then gave us a multiplication table of square numbers starting from $1 \times 1 = 1$ to $12 \times 12 = 144$. My teacher gave us a week to memorise the table. I practised it every day before I went to bed. I did it on my own without the help of my mother. She just sat and looked at me struggling to memorise the tables. I sometimes became frustrated that I was able to memorise from 1×1 to 7×7 but struggled with numbers from 8×8 going up to 12×12 . After days of repeated practice, I still

struggled to memorise the 12 numbers. I felt as if I were not smart enough. I felt as if I were a *domkop*³. Learners who were slow and struggled to understand concepts were often described as stupid in class. Now I felt like one of the stupid ones. I suddenly realised that mathematics required a lot of thinking and less playing.

One day, while I was practising my multiplication tables in class during lunchtime, I was not aware that my teacher was there. She saw me practising and listened to me saying my tables. I remember her saying “Sixty-four. Eight times eight is equal to sixty-four”. Oh, I felt embarrassed and I immediately stopped practising. She said I should not stop. I was a very shy child. I did not want to continue, more especially because I knew I was struggling with the following tables:

$$8 \times 8$$

$$9 \times 9$$

$$10 \times 10$$

$$11 \times 11$$

$$12 \times 12$$

She kept on saying, “Do it again,” with a smile on her face. I decided to start again. With much energy and confidence, I started:

$$1 \times 1=1$$

$$2 \times 2=4$$

$$3 \times 3=9$$

$$4 \times 4=16$$

$$5 \times 5=25$$

$$6 \times 6=36$$

$$7 \times 7=49$$

$$8 \times 8=...$$

I paused for a moment and remembered her voice saying, “64. $8 \times 8 = 64$ ” and then I said 64. My energy level dropped. When I was supposed to continue with 9×9 , 10×10 , 11×11 and 12×12 , I completely stopped. With a very shy and sad

³ **Domkop** is the Afrikaans word meaning stupid.

face, I looked at her and she looked at me. When she was about to say something, the bell rang, and the other learners started moving into the classroom.

She called us to the front, one by one, to do a multiplication table. I was relieved to see I was not the only one struggling. Many of us struggled, but I was even better than many other learners were. Some did not even know how to start. I was sitting in the front row and saw one boy, Chris, standing in front and not saying anything. The teacher kept on saying "Chris, talk. We are listening". He just looked at the teacher and said he did not know the multiplication table. The teacher shouted at him and said that he did not practise. I was the next learner who had to go the front. I was scared of being treated in the same manner because I was always the clever one, but at that stage, I felt that I was unable to finish the multiplication table. I also was scared that the other learners would laugh at me.

When I had to go to the front, I started confidently, and reaching 8×8 I did not hesitate because I could still hear my teacher's voice at the back of my mind saying, " $64. 8 \times 8 = 64$ ". When I had to recite 9×9 , tears rolled down my face. One of the boys, who often used to bully me daily, started to laugh at me. Firstly, I was scared of being beaten by the other learners, now this boy was laughing at me, which made me feel stupid. The teacher looked at him and told him to stop teasing me. She took a pipe, which I thought she was going to use to beat me, but she hit him with it instead.

The following day my teacher was sitting at her table, marking our books. I greeted her, "Good morning, ma'am". She replied, "Good morning, sweetheart. How are you?" I said I was good and quickly went out. As I left the room, I heard her asking if I had practised the multiplication tables. I knew she was going to ask that question. This gave me a good reason to leave quickly and play with my friends.

Another incident happened when we had mathematics after a school assembly. We were all scared because we all had to know the multiplication tables from 1×1 to 12×12 and say it without looking at it. It turned out that our teacher had planned something else. Instead of asking us to stand up and say the multiplication tables, she divided us into groups. She separated the girls from the boys and gave us 10 minutes to help one another to study the tables before we

played a game. There were 15 girls and 17 boys. The group that won would receive sweets. The groups would also receive sweets for each correct answer. She called numbers randomly. The girls won the contest. During the game, I was able to recall the answers to 9×9 , 10×10 and 12×12 . I struggled to remember 11×11 , but I was very proud of myself for knowing 9×9 , 10×10 , and 12×12 .

My teacher believed in combining singing and dancing with mathematics. She made us sing the multiplication tables in order for us to know it by heart. Hence, we sang every day in the morning before lessons. We sang multiplication tables. This resulted in me still remembering the tables, even when I went to university. The following are the lyrics of a song she taught us.

Lyrics

This is a times table song

Learn and sing along

Multiplication table

Let's sing together

One times one is one

Two times two is four

Three times three is nine

Four times four is sixteen

Five times five is twenty-five

Six times six is thirty-six

Seven times seven is forty-nine

Eight times eight is sixty-four

Nine times nine is eighty-one

Ten times ten is hundred

Eleven times eleven is one hundred and twenty-one

Twelve times twelve is one hundred and forty-four

This is a multiplication table

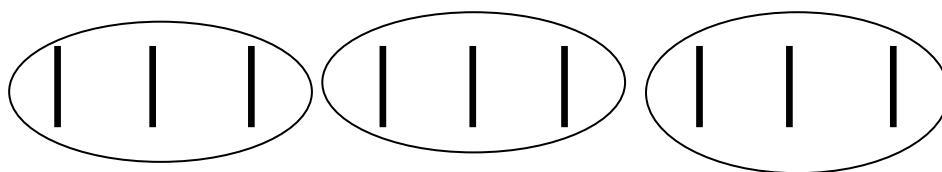
Let's sing it one more time.

My teacher was doing a great job in teaching and she made me enjoy mathematics. During all this, my mother continued to support me. She ensured

that she knew what I had to learn in order for me to practise it at home. She made sure that I knew most of the topics that I had to learn in class.

When I was in grade 2, we moved into a government-subsidised four-roomed house. The house was given to my grandmother, who had been on the waiting list for a house for many years. The house formed part of the Reconstruction and Development Programme (RDP), which the non-racial South African government instituted to provide basic needs, such housing, to Blacks, Coloureds and Indians after the collapse of apartheid. My grandmother's RDP house provided us for the first time with a kitchen, sitting room and two bedrooms. My mother and I could continue with my mathematics lessons at the kitchen table, while the rest of the family sat in the sitting room and listened to the radio. She took a blank piece of paper and asked me to bring my bottle tops that I still used for my calculations. I went to the bedroom, fetched the plastic bag in which I used to carry my books, and took out the bottle tops.

I was fascinated by the word division. I always got excited whenever my mother taught me something new in mathematics. She wrote a division sign on the paper and explained to me what it meant and what was required of me when I saw a division sign. She gave an example by using 9 divided by 3 in order to demonstrate division to me. She first wrote $9 \div 3$ and taught me how to say it, "Nine divided by three". She then drew nine sticks on a piece of paper, counted three sticks and made a circle, counted another three and made a circle. Three sticks remained, and she circled them, to demonstrate to me how to do division. After she had counted, there were three circles. This demonstrated that $9 \div 3$ equals 3.



It was only a week later that I was taught how to divide in class. This made me excited, because I could already do such a calculation and it was not going to be a problem for me. My teacher gave me the same problem that my mother had given to me, $9 \div 3$. She wrote it on the chalkboard and before explaining anything, she asked, "Who can tell me what this is?" Without wasting any time, my hand was up.

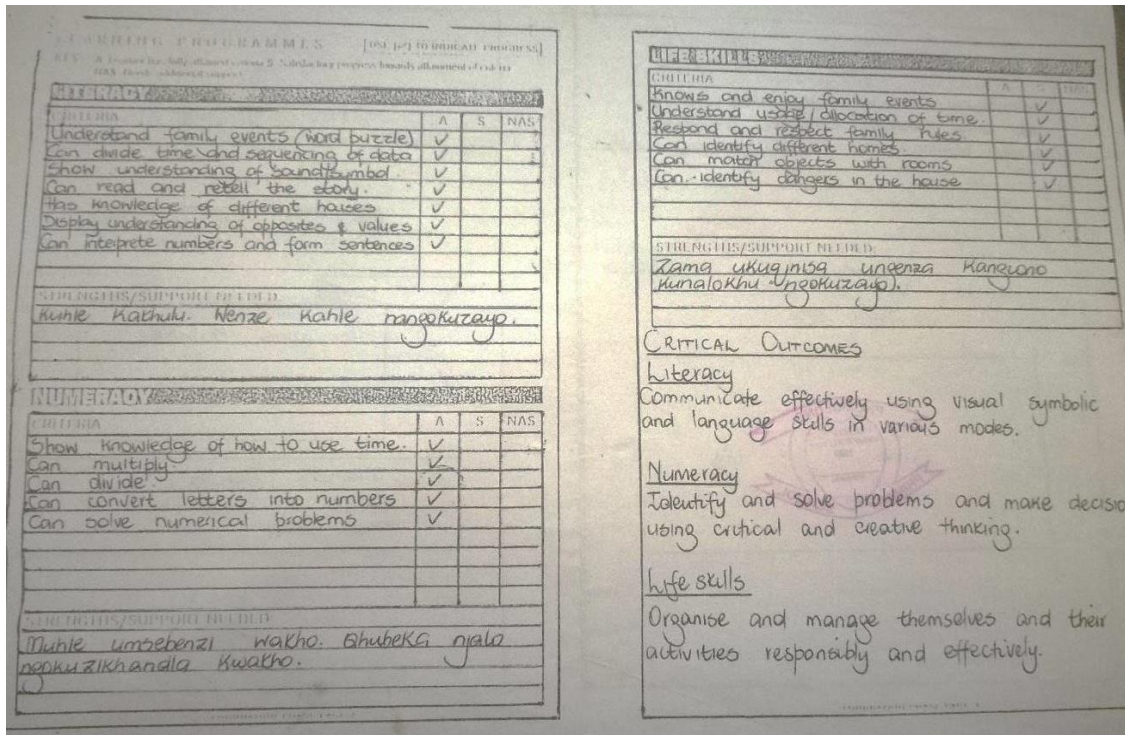
In amazement, she asked, "What is it, Dorcus?" I replied and said, "9 divided by 3. The answer is three". For a moment, she kept quiet and looked at me. I was surprised that she did not say anything. After a few seconds of silence, she said, "Good girl. Clap hands for her." As much as she knew that I was smart, I did not think she expected me to know the answer to her question.

My teacher did about five more examples with us. Most of the learners found it difficult to understand. The bell rang for us to go home, but the teacher wrote 6 divided by 2 on the chalkboard and said that she would only dismiss us if we could give her the correct answer. Learners had to whisper the correct answer to her on their way out. If they had the correct answer, she would release them, but if they answered incorrectly, they had to remain behind. She would then help those who remained behind to understand the work. When I whispered the answer to her, she released me immediately. Most of the learners had to remain in class to be supported by our teacher. The next morning, she told me that I should tell my mother that she was doing a great job with me when I told her that it was my mother, who was helping me with mathematics.

I also remember going to my teacher's office with four friends one afternoon. We experienced a problem and we went to ask for help with a multiplication problem. Her door was wide open. She was marking our workbooks. She smiled at us and invited us in when she saw us standing at the door. She took our mathematics textbook, looked at the problem, and solved it within a minute leaving us in amazement. She demonstrated to us how she did it. I said to her, "Ma'am when I grow up, I want to be a teacher like you in order for me to teach mathematics." My teacher did not only know her subject well, but she was also a happy teacher who enjoyed her work. She was always the first one to arrive at school in the morning and the last one to leave in the afternoon.

4.4 STORY FOUR – MATHEMATICS IS BORING

The report card below is proof that I was excelling in mathematics and enjoying it. I achieved an A symbol, which meant that I had fully attained the criteria. The teacher commented in my report card and said, “*Muhle umsebenzi wakho. Qhubeka njalo ngokuzikhandla kwakho*”. This meant that my performance was excellent and that I should continue to be as determined as I was at that stage.



Picture 7: My grade 2 report card

After I had passed grade 2, I had many expectations from my grade 3 teacher. I thought that every teacher was like my grade 2 teacher, however, my grade 3 teacher was different. She had a different way of teaching. She never made us sing but she used a method where we would all recite together. She called out multiples of two from two to 20 and made us say the multiples after her. She never involved us in her lessons. She used direct instruction more than other methods of teaching. However, even though she did not involve us, her lessons were understandable, and she would assist us if we struggled. She cared for us.

When schools closed for the June holidays, my teacher went on maternity leave. When schools reopened in third term, we had a substitute teacher. This teacher

was very strict and seldom smiled. When we went to class on the first day of school, she welcomed us and introduced herself to us. She told us that she was going to be our teacher from then onwards.

We did not have a problem being taught by somebody else, but our lessons were boring. Her first lesson was dealing with addition and subtraction. We worked with numbers that had two digits like 10, 20, 30 and other numbers. She just wrote three sums and said that we had to write. She did not even bother to explain anything. We understood the concepts because we did it in grade 2. Therefore, it was not a problem completing the class activity. Most of us scored full marks for the exercises. One of the learners asked her, “Ma’am, why are you not teaching us like our own teacher?” She lost her temper when she heard that question. She was facing the chalkboard and turned to the class, looking straight at me as if I had asked the question. I denied it and pointed to the learner who had asked the question. She shouted at us and demanded that we not compare her to our permanent teacher.

She told us that she hated teaching. She left me with the impression that she did not love learners. She taught us as if she did not have a choice other than to be in the class and surrounded by children. Neither did I think she liked me because I was one of those learners who was very smart and who asked many questions during the lessons. Clever learners seemed to annoy her. Once when I asked her a question, she responded by saying that I had to keep my mouth shut or else she would beat me. According to her, I asked too many questions and I was boring. I felt hurt by these responses. Her reaction to me caused me to almost fail mathematics, like many of the other learners, in the third quarter. In contrast to the other learners, I was fortunate to have a mother who understood mathematics and who could assist me with my homework and difficult problems. My mother noticed my poor performance and the declining lack of interest in mathematics. She used the textbooks to teach me and restore my love for the subject enabling me to pass it at the end of the year.

4.5 STORY FIVE - LEARNING MATHEMATICS IN ENGLISH

In 2002, I progressed to grade 4. On the first day of school, I arrived late to find everybody already in class. My mother accompanied me to school in order to meet

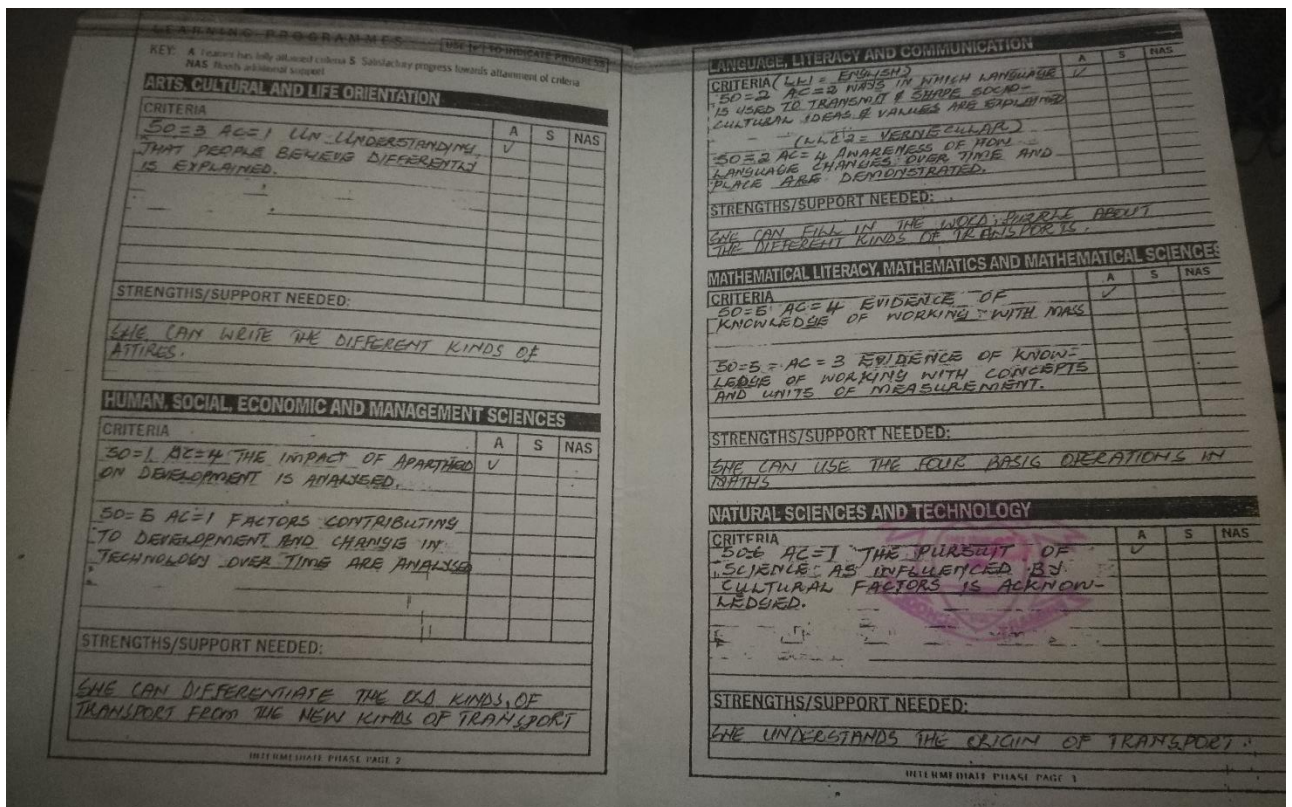
my new teacher. My teacher greeted me in Sepedi and directed me to go and sit next to a girl who was sitting alone, by saying, "*Dula mo le.*" I was confused to hear Pedi in class and thought that I was in the wrong class, because I was Zulu-speaking and did not expect to hear another language to be spoken in class. Since I had started school, my class teachers were Zulu and I was taught in my mother tongue.

A few minutes later, my teacher left the class, and another teacher entered. She introduced herself as our mathematics teacher. I was more confused about this change of teachers. Later I realised that in grade 4, unlike the lower grades, different teachers would teach different subjects. In grade 4, we were not only taught in our mother tongue, but we were also taught in English. In our class, we had Zulu-, Xhosa-, Pedi- and Tsonga-speaking learners.

My new mathematics teacher loved her subject and was always energetic during her lessons. I enjoyed her lessons on place values. She taught us the difference between units, tens, and hundreds. I had a teacher who promoted her subject by making complex problems to look easy. She reminded me of my grade 2 teacher. However, it was challenging to have my mathematics lessons in English. I was used to being taught in my mother tongue. To be taught by different teachers, with the medium of instruction, as well as the increase in subjects, caused me to underperform in mathematics in the first quarter. Despite these barriers, I still felt inspired by my mathematics teacher's lessons and scored 70%. During that time, I still used my bottle tops, which I had used during my mother's lessons.

We did not have any resources that we could use to count in our class, so now most of us used bottle tops. Our grade 4 teacher, used to teach us and then make us come to the front to teach others. As much as I was good at mathematics and enjoyed it, I never wanted to go to the front to teach because I did not know how to speak in English. I remember one day she said, "I will call out a name and when I call you, you must come to the front and do a presentation for us." I prayed that she would not call my name. While I was busy praying, I heard, "Dorcus Mlangeni." That is my name. "Oh no!" I thought, "Why me?" I was shaking. I remember standing there, saying nothing. I did not know where to start. I had to do a presentation about addition of three digits using a column method. Therefore, I

decided to speak in my mother tongue. Just as I began to speak the teacher said, “English.” I looked down; I felt embarrassed and shy. I knew that my classmates were going to laugh at me, and they did. Unlike my second-grade teacher, Mrs Skhosana, who always taught us that we should not laugh at other learners, Mrs Matheka did not have a problem with my classmates laughing at me. I almost cried and she said I must sit down. As I was going to sit down she said, “How can a very smart kid like you struggle to present a simple concept?” She did not realise that I was struggling with speaking in English. My confidence dropped because of a language, a language that is not my mother tongue. I knew how to read and write English but speaking it was very difficult for me, because I was never taught in English in the previous grades and at home, we only spoke IsiZulu. I passed mathematics in grade 4 by God’s grace. Most of the time I struggled to understand my mathematics teacher when she was teaching. There was a language barrier. The funny thing is that I passed with high marks.



Picture 8: My grade 4 report card

My grade 4 report card shows my performance as well as the teachers’ comments for different subjects. Even though I did not understand the teacher, I was able to follow her when she was doing examples. In addition, the extra lessons that I was

receiving from my mother helped me a lot. My mother had taught me the four basic operations until I excelled in them. When we talk about the four basic operations in mathematics, we are talking about:

- Addition (+)
- Subtraction (−)
- Multiplication (×)
- Division (÷)

With help from my mother and the effort I put in practising mathematics, I was able to get an A symbol in mathematics that year. On my report card, the teacher commented that I was able to use the four basic operations in mathematics.

In the fifth grade, I was placed in a mathematics class. I am calling it a mathematics class because our class teacher was the only one teaching mathematics in grade 5 and all the mathematics resources were located in our classroom. I was looking forward to grade 5 mathematics because of the mathematics teacher, Mr Mdatyulwa. When I was a little girl aged five, I used to go with my uncles (Ntokozo who is the last-born and Siphon who is the second last born from my mother's side) to school when my mother had gone to work, as I had no one to look after me. Mr Mdatyulwa was their mathematics teacher and I remember how energetic he was when he was teaching mathematics. I also remember that he used to give me a worksheet of fractions to do when I visited. I liked him so much. Moreover, because of these prior experiences, I was looking forward to being taught by him. He was a very old man who loved children. His mathematics classes were amazing, even though he used to beat us or make us clean toilets whenever we failed his mathematics tests. Our class was full of mathematics charts that he wrote himself and we used those charts to learn and remind ourselves of the various concepts.

That year I did so well in mathematics that I was chosen to represent the school at the Mathematics Olympiad, which was being held at a neighbouring school in Tembisa. My friend Lerato and I were given private lessons by Mr Mdatyulwa to prepare us for the Mathematics Olympiad. I remember learning about exponents

and the teacher telling us that anything to the power of zero is equal to one and anything to the power of one is equal to that number. Exponents are shorthand for repeated multiplication of the same thing by itself. For example, 2^3 means $2 \times 2 \times 2 = 8$. I also remember confusing zero divided by a number and a number divided by zero. I used to say, a number divided by zero is zero, for example $5 \div 0 = 0$ and zero divided by a number is undefined, example $0 \div 5 = \text{undefined}$. But, the reverse is actually true, with $0 \div 5 = 0$ and $5 \div 0 = \text{undefined}$. We went to the first round of the Mathematics Olympiad and I came first in Tembisa, so I qualified to go to the next round, which was the district level. A week passed and then we went to a school called Laerskool Kempton Park. I remember when we arrived, I saw many White learners. I asked my teacher if they were also there for the Olympiad, to which he said, "Yes. *Beze ukuzo compita nabo. Ubabethe ungabادلalisi wena mntwana wam. Ungathuswa ngabelungu. Bayafana nawe cha ibala labo limhlophe* (Yes, they are also here to compete. You must beat them my child. Do not be intimidated by them. They are just like you except that they have a white skin colour.)"

I went inside the venue and sat by the corner. I was prepared for the test, but when they handed out the question papers, a White man started explaining the instructions in English. Immediately after that, he switched to Afrikaans. I wondered why the other learners were being given instructions in their mother tongue, while we were being given instructions in a language that was not ours. The question paper too was written in both English and Afrikaans. I then realised that being White is a privilege. You get to be taught in your mother tongue, the schools you attend are big, and you have many resources, unlike our schools. I thought that it must be nice to be a White person, and I still think that, even today. We were given few minutes to finish the test, although I cannot remember how many, but the time passed quickly. I wrote and I passed. Furthermore, I came in second position. A White boy came first and a Black boy came third. The three of us had qualified for the provincial level. I cannot remember much of the things that happened at the provincial level, except that I came in fifth position and did not make it to the nationals. I remember my class teacher Mr Mdatyulwa being very proud of me. I enjoyed mathematics and the lessons in grade 5.

I do not remember much of what happened in grade 6, except Mr Xaba beating us every day, even when we did nothing. I think he enjoyed beating us more than he enjoyed teaching us mathematics. Every time he asked us a question, he would not give us time to think or work out the solution. You were expected to answer immediately. If you did not answer him, he would beat you, or sometimes he would even beat you while you were answering him. We were never happy when it was his lessons. He looked like he was good at mathematics and he seemed to enjoy teaching, but not as much as he enjoyed beating us. He had a very long brown pipe that he used to beat us with. That made us very uncomfortable and consequently, many of the learners failed mathematics. I remember one day I had not done my mathematics homework. His period was the last before long break, so I decided I was going to pretend that I was sick so that he would not beat me. He really liked me though. He said I reminded him of his niece. He said my eyes were like the eyes of his niece and that I was the same height and size as his niece, so I used that to my advantage. I cried when he entered the class and when he asked what was wrong, I told him that I was sick. He took me to the office, so that they could take care of me. I survived being beaten by him. Even though I do not remember how well I did in mathematics in grade 6, I think I did well and I do not remember failing.

I cannot remember the name of the teacher that was teaching me mathematics in the seventh grade. I do not even remember what we did. The only thing I remember was that mathematics was boring and that we did not have a mathematics teacher for about three months, that is, the whole of second term. We tried teaching ourselves mathematics, but it was pointless because we did not know which concepts were to be done in the seventh grade. I remember one day, while we were trying to teach ourselves mathematics, the principal came in and asked who wanted to change classes and attend classes in Block A. I raised my hand to show that I was willing to go to Block A. As a result I moved from one side of the school, Block B to the other side, Block A. Our school was very big so it was divided into two. The old school building was called Block A and the new school building was called Block B. I was in Block B from grade 3 to grade 7. Around July, I moved from the new building back to the old building because I wanted to experience what it was like to be taught by teachers in the old building and to meet

new friends. I was excited to move, especially because we lacked a mathematics teacher for a long time. What I realised when I got to the old school was that I had no competition in mathematics. I remember many people struggled to do a long division method that I had mastered in grade 5. Yet in grade 7 there were still people who could not do it. I was surprised.

I also remember writing our first mathematics test in July. One of the boys I attended class with asked the teacher if he could use a calculator and the teacher said, "*Gwa tshwana Shadrack le oka berekisa calculator otlo no fail. (It does not matter, Shadrack. Even if you can use a calculator you are still going to fail.)*" Wow, after hearing those words I thought to myself that maybe this boy was very bad with mathematics. The teacher did not allow any of us to use a calculator, except for Shadrack. Now, one boy by the name of Paul used to attain the highest marks in the class before I arrived. I remember getting 100% for the test and the teacher was shocked. She asked, "Who is Dorcus?" I raised my hand and she said, "Well done. How did you do it? Who taught you mathematics?" I did not know what to say, so I just took my script, smiled and sat down. She said, "You are number one and Paul is number two with 60%." Then she said to Paul, "*Paul ofitile ke ngwanyana! Ake tshepi. (Paul, a "girl" has got marks higher than yours. I cannot believe it.)*" Well I was very good at mathematics. From that day, everyone in class started coming to me when they did not understand anything in mathematics. I became Mrs Mohothwane's favourite learner. Every test we wrote I got the highest marks and Paul came second. His marks were not even close to mine, that is why I am saying I had no competition. This was unlike the situation in the new building where there were many of us fighting for the mathematics awards.

In general, therefore, my primary school mathematics life was great. I had few good teachers, who really enjoyed what they were doing. I passed all my grades and never failed mathematics because of the help I received from my teachers and also from my mother, who kept on teaching me, even when I had started going to school. Though there were a few other grades later where I did not enjoy mathematics, the foundation I received from my mother and from Mrs Skhosana, my second grade mathematics teacher, really helped me achieve success in

primary school. Most of the things that we did in the other grades seemed to be a repetition of what I had done in second grade.

4.6. STORY SIX – SECONDARY SCHOOL MATHEMATICS



Picture 9: Jiyana Secondary School

In the year 2006, I enrolled at Jiyana Senior Secondary School, a school situated in the west of Tembisa at a place called Entshonalanga (Sunset) Section. The other surrounding sections are Umthambeka and Endayeni. These are the places where Zulu-speaking people resided in the times of apartheid. These three sections are known for having the highest level of crime and violence in Tembisa. In 1994, there was a very notorious gang, the Toaster Gang. This gang was based in Umthambeka, a section just next to my secondary school. The gang was formed in late 1991, the same year I was born. Maybe it was even formed in the same month. Who knows? My mother told me that the gang used to rape high school girls, especially those who attended Jiyana Secondary School, as it was the school closest to them.

Jiyana Secondary School was known for its extremely high levels of rape, murder, theft, violence and corruption that occurred on the school premises. According to one story, a girl was raped and then pushed from the third floor balcony. A teacher tried to save the girl, but she fell and died. As a result of all the scandals at Jiyana Secondary School, the Department of Education decided to close the school. However, it was reopened after few years. When I enrolled at Jiyana in the year

2006, my mother was not happy because of the school's history. But, I had no choice other than to go there because it was the closest school to where we lived. I walked 15 kilometres to get to school every day, but the other schools were even further. Luckily, by the time, I enrolled at Jiyana Secondary School, the level of crime and violence had reduced. It was nice being at the school, though there were still few other learners who were a part of a gang situated in Umthambeka Section.

When I started grade 8, I was placed in a class with more than 60 other learners. There were 13 grade 8 classes and I was in an F class. As a result, we had more than one teacher teaching each subject. I was very lucky, or should I say blessed, to be in one of the classes that were taught by Mr Mcethe, the Head of Department (HOD), who was a grade 8 and 9 mathematics teacher. He taught six classes (A to F), that is why I am saying I was lucky, because I was in the F class. The other classes were taught by the other teacher. Mr. Mcethe was a very good mathematics teacher. He made mathematics classes fun and exciting. His voice was too soft we used to laugh at him sometimes when he spoke. I remember him saying, "Co-interior" with his tiny voice. He taught us about different types of angles. An angle is formed by two lines or rays diverging from a common endpoint called the vertex. He taught us about the angles formed when a transversal line passes through two parallel lines, that is, alternate interior angles, corresponding angles, and co-interior angles. To help us with these concepts he used the word FUN.



I remember him using big N, F and U signs made of metal to teach us the difference between these angles. He told us that the alternate interior angles should be inside the N or Z shape, the corresponding angles made an F shape and co-interior angles made a U shape. To this day, I still know these three angles by heart. No one else but Mr Mcethe has ever taught me about these angles. I

was very smart and understood mathematics, but the energy and love that Mr Mcethe had for mathematics made me love it even more and helped me to achieve great marks. I also remember him teaching us the laws of exponents. Who! Now that was one of the most challenging concepts I came across in my grade 8 life.

Name of the Law	The Exponent Law	Example	The Simplified Value
First Law	$a^m \times a^n = a^{m+n}$	$2^2 \times 2^3 = 2^5$	32
Second Law	$a^m \div a^n = a^{m-n}$	$2^5 \div 2^3 = 2^2$	4
Third Law	$a^0 = 1$	4^0	1
Fourth Law	$(a^m)^n = a^m \times n$	$(2^2)^3 = 2^6$	64
Fifth Law	$(ab)^n = a^n \times b^n$	$(10)^3 = (2^3 \times 5^3) = 2^3 \times 5^3$	100000
Sixth Law	$(a/b)^n = a^n/b^n$	$(2/3)^4 = 2^4/3^4$	16/81
Seventh Law	$a^{-n} = 1/a^n$	$2^{-4} = 1/2^4$	1/16
Eighth Law	$(a/b)^{-m} = (b/a)^m$	$(2/3)^{-4} = (3/2)^4 = 3^4/2^4$	81/16
Ninth Law	$(1/a)^{-m} = a^m$	$(1/2)^{-4} = 2^4$	16

Table 1: The laws of exponents

The exponent of a number says how many times a number is multiplied by itself. For example, $2^4 = 2 \times 2 \times 2 \times 2$. He gave us a table like the one above to go and study the laws of exponents. First, I saw letters and I asked myself, "What kind of mathematics is this where they use letters instead of numbers?" In grade 8, we only learnt about the first and second laws of exponents. The teacher focussed on teaching us multiplication and division of exponents with the same base. It was very easy for me to multiply or divide exponents that had the same base because the only thing I had to do was to add the exponents. The challenge I had was when I had to simplify the exponents. I remember being punished because I failed a class test where we had to simplify the exponents. Instead of multiplying a number by itself, I multiplied the number or base by an exponent. For example, 2^3 , instead of saying

$2^3 = 2 \times 2 \times 2 = 8$, I said $2^3 = 2 \times 3 = 6$.

So, all my answers were wrong and then I got myself a punishment. I was beaten five times with a duster on my fingers. I can still remember Mr. Mcethe's words when he was beating me. He said I disappointed him and for that reason, I would mop the classroom alone. Let me tell you, I was not the only one who failed, but I was the only one that was punished. I was bored and irritated, but I could not hate him. He was my second favourite mathematics teacher, so how was I going to hate him? Mom once said to me, "If you do not like a teacher or the subject, then that subject would not like you too." By that, she meant that if I hated a subject or a teacher, then I would fail the subject because I would not have an interest in it. Therefore, I had to love Mr. Mcethe, even when he punished me a lot. Every time I failed or did not get the marks that he expected me to get, I knew that I was going to get a punishment.

I have many memories about my grade 8 mathematics life. I remember doing fractions in class, and helping a friend, who was struggling with division of fractions. I was very proud of myself when I taught her until she was able to do it. Most of my classmates hated me. They hated me for being smarter than them. There were two girls in my class who once accused me of practising witchcraft. They said, "*Wena waloya. O phela othola di maraca tse fitang tsa rona because waloya.* (You are a witch; you always get marks that are higher than ours because you are a witch)."

It is funny now when I think of it. Back then, it hurt me and I cried. The incident took place during end of the year exams, a few minutes before we wrote our final mathematics exam for the year. I was sitting alone practising mathematics. My desk was in front and in the third row from the door. I remember the two girls taking the paper I was using to practise, saying I wanted to cheat in the exam. They took my paper, tore it up, and threw it into the bin. I looked down for a moment, I wanted to cry but I did not. I cry most times when I am hurt. Instead, I stood up after a while and took out another piece of paper from my book and began practising. They took it again, so I decided to stop practising. When the time came, we wrote our mathematics exam, and I passed. That December, when my mother and I came to fetch my report card, I saw the two girls with their parents. They had both failed the grade, while, guess what, I had passed. I was scared of

them, so I did not laugh at them. While we were on our way out, I asked my mother to accompany me to one of the teachers' offices. There was someone I wanted to give thanks to. It was Mr. Mcethe. He said we would meet again the following year, in grade 9, which made me very happy. I did not want to be taught by the other mathematics teacher because I had heard negative stories about him. I heard that he did not attend his lessons and the learners had to teach themselves.

Then it was 2007 and I was in grade 9. On the first day of school, I was sitting with my mom waiting to be allocated a class. I was placed in grade 9E, with the same learners that I was with in grade 8. There were a lot of us in the class and some learners did not have a place to sit. The classroom was overcrowded and noisy, which resulted in the teachers not being able to keep discipline. I remember sharing a chair with a friend because we were short of furniture. It was very uncomfortable but we had no choice. A few weeks later, the deputy principal entered the class during a history lesson. She said that there were learners who were to be moved from grade 9E to grade 9F because of overcrowding. Whoooo! I prayed not to be moved because I wanted to stay in Mr Mcenthe's class. The deputy called out names; about 20 learners were to be moved. As she was busy calling out names, I was counting and praying. But then she reached the 20th learner and my name was called. "Oh, my God, why is this happening?" I was a very quiet learner, so I did not even complain. I just took my bag and left.

Changing classes was not an easy thing to do. You have to leave your friends behind and start making new friends, which is such a mission because you are not sure if the learners from other class will accept you. I felt very uncomfortable. We arrived at the other class during a mathematics lesson. The deputy principal introduced us and gave a place to sit. It was good that I had a place to sit and the class was not too overcrowded. There were still a lot of us though. We had about 60 learners in the class. We sat down but I was annoyed. The teacher was teaching but I did not pay attention because I had heard previously that this teacher did not teach most of the time, so, I already disliked him. After school I went home and told my mom what had happened and that I did not like the new

mathematics teacher. My mom said that I should teach myself to like him because he was not going anywhere.

During this grade I started to be naughty. I would skip classes and not attend my mathematics and technology classes. I did not do my classwork and homework. I remember leaving home saying I was going to school but went to sit in the park until school came out. I was absent a lot when I was in grade 9, especially during second and third terms. One day, when I was sitting in the park, a parent saw me and took me to school. The principal asked why I was behaving the way I did. I did not have a reason, but I knew that reason was that I did not enjoy any of the subjects, except natural sciences. The class I was in was very disruptive compared to the class I was moved from. The teachers did not attend classes and that also made most of us rebellious. During the second and third terms, my marks were very low because I was not doing my work. My mom noticed that my mathematics marks had dropped and she became worried. I had passed mathematics and failed technology but my mom was stressed as to why my mathematics marks dropped. She shouted at me. She went to the school to ask about my behaviour and the class teacher told her that I was bunking classes. Immediately my mother heard that she turned and looked at me with a very angry face. Oh, I knew that I was going to be punished for what I had done.

When we got home, she shouted at me really loudly and punished me. I could not see my friends for about a month and everyday when I came back from school, she asked about my schoolwork. Around October and November of that year, I pushed very hard because I was scared that I might fail at the end of the year. So, I worked very hard and submitted all the work I had not submitted previously. We were doing CTA (Common Task for Assessment) in grade 9. CTAs are one of the educational programmes that were compulsory in South Africa. They consisted of 25% of the year mark. These assessments were really challenging and at the end of grade 9 I got 66% for mathematics.

When we were choosing subjects for grade 10, I chose the mathematics and science stream. If my marks were very low in mathematics, the school would have

not have allowed me to do mathematics. The table below shows the streams we had to choose from for grade 10 subjects.

STREAM	SUBJECTS	REQUIREMENTS
FIRST: Science	<ol style="list-style-type: none"> 1. Mathematics 2. Physical Science 3. Geography/CAT 4. Biology 	<ol style="list-style-type: none"> 1. Mathematics, at least level 4 (50%) 2. At least level 5 (60%) in mathematics in order to do Computer Application Technology.
SECOND: Commerce	<ol style="list-style-type: none"> 1. Mathematical Literacy 2. Accounting 3. Business studies 4. Economics/CAT 	<ol style="list-style-type: none"> 1. At least level 3 in mathematics (40%) 2. At least level 5 (60%) in mathematics in order to do Computer Application Technology.
THIRD: Arts	<ol style="list-style-type: none"> 1. Mathematical Literacy 2. Business Studies 3. Economics/CAT 4. Visual Arts/Dance/Drama. 	<ol style="list-style-type: none"> 1. At least level 5 (60%) in mathematics in order to do Computer Application Technology.

Table 2: FET subject choices

Because I had achieved 66%, I was given an opportunity to do any subjects I wanted to do and to also choose which subject I wanted to do between Geography and Computer Application Technology (or CAT). Learners who achieved a percentage lower than 60% in grade 9 did not have this choice. The system automatically selected Geography for them.

In the year 2008 in Grade 10, I was doing mathematics, computer, and physical science subjects. I was placed in the A class with many other intelligent learners. The first time I entered the class and saw all these learners, I was motivated to compete with them for awards every year. I was amazed to be with them, and said to myself, “*Wow, zizobuya la,*” meaning, It is going to be hectic or it is going to go down in here. I could feel the competition the moment I stepped into that class. Every teacher who entered our class was shocked and intimidated by this class. I

remember our English teacher did not show up during the English lessons. Her excuse was that we were very smart learners, and therefore we could teach ourselves. And we did. We taught ourselves English until grade 12. I was extremely happy to be in this class. Though I knew the competition was very tight, I was grateful to be a class full of hardworking learners. We had Mrs Dlamini as our mathematics teacher and she was very smart, strict, and energetic. She was very short, had long dreadlocks and liked wearing high heeled shoes.

I was doing pure mathematics as we called it. Back then during our high school years, most of our peers were very scared of pure mathematics. They said that it was very difficult and frustrating. I loved mathematics, so I did not care what people were saying about it. I knew I was going to kill it. Whether it was pure mathematics or what we called fake mathematics (mathematical literacy), I knew that I was going to do well, especially because I had my mom to help me.

I do not remember our first lesson with Mrs Dlamini, however, I do remember her introducing herself to us. She was smiling and kept calling us girls, “Ntombi” meaning girl. She was passionate. She is actually the one who inspired me to study a Bachelor of Education, so I could become a teacher. When she was teaching mathematics, she would first introduce the topic or concept by writing notes on the chalkboard for us to copy into our books. Then she would explain the notes by giving many examples. She used different methods when doing her examples. She tried to bring things down to our level of understanding, as her aim was to make sure that everyone understood mathematics. She did not care about quantity; she cared about quality. I can attest that most of the learners who were taught by Mrs. Dlamini are very good at mathematics today. I recall the time we got our first mathematics test marks; Mrs Dlamini announced the marks in the class in front of every learner. She started from the lowest to the highest. She called out people’s names until there were two scripts left. It was my script and that of another girl called Linda. The person who scored the highest mark was Linda. For the first time, I was second in mathematics, which was so unlike me. I was used to being the highest, so I was disappointed in myself. I was not the only person who was disappointed. Four other learners were disappointed as well. I remember there were five of us in class, who fought for first position in

mathematics, three girls and two boys. During lessons, my friend Lerato and I would work together while the two boys and one girl worked together.

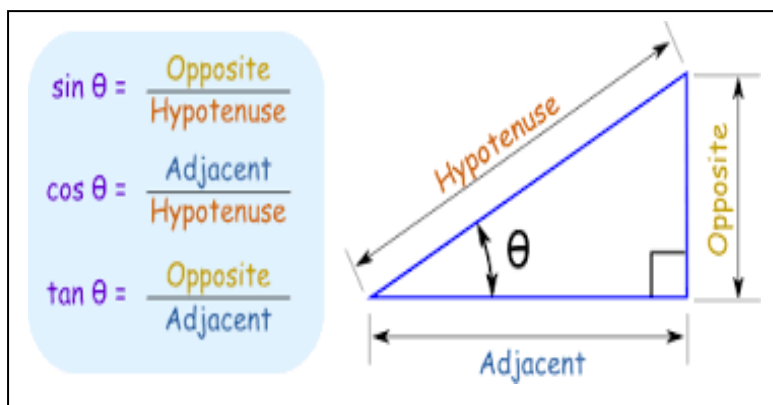
I remember doing factorisation in grade 10. Factorisation is the opposite of expanding brackets. For example, expanding would require $(x + 2)(x + 3)$ to be written as $x^2 + 5x + 6$ whereas factorisation will start with $x^2 + 5x + 6$ and end up with $(x + 2)(x + 3)$. This was one of the most challenging concepts I faced in grade 10. Most of us learners found it challenging to find the factors of numbers. Mrs Dlamini taught us factorisation and then gave us a test out of 10 to test how much of the work she had taught us we understood. In that test, I got 5 out of 10. Most learners failed the test. After failing the test, Mrs Dlamini came up with a different way of teaching factorisation. She first changed the language she used. She stopped speaking in English and spoke in the language that most of us understood better, isiZulu. She explained English terminology in isiZulu and that made it easier for most of us to understand. The second test we wrote I passed very well and got marks higher than the rest of the class. One of the two boys who were in competition with me in mathematics said, "*Haibo! Sekukwesibili ngihlulwa intombazana nge maths. Eh lamantombazana a strong yong*". The word "*Haibo*" indicates that a person is amazed. The boy said that it was the second time a girl got higher marks than his. The first girl was Linda and I was second, with the factorisation test. He said this while laughing. He also mentioned that maybe he should start practising mathematics with us. I remember laughing at him after he said that. I even said to him he was welcome to join us, but I was still going to show him flames.

I also remember doing trigonometry for the first time in grade 10. Trigonometry is about triangles and it helps us to find distances and angles. Its main functions are sine, cosine and tangent. When the teacher introduced trigonometry, I remembered that my dad once said something about it when he was bragging to me about how great he was with mathematics. He mentioned the term trigonometry and said something like "soh-cah-toa". He was talking about Sine, Cosine and Tangent. Soh cah toa meant:

SOH – **S**ine is the ratio of the **O**pposite side to the **H**ypotenuse

CAH – **C**osine is the ratio of the **A**djacent side to the **H**ypotenuse

TOA – **T**an is the ratio of the **O**pposite side to the **A**djacent side



Picture 10: Trigonometry

When my dad was talking, I did not hear much of what he was saying because I was not paying attention. However, I had heard the above word and I asked him what Soh-Cah-Toa was. Thereafter, whenever I was doing trigonometry, this Soh Cah Toa thing helped me to memorise the sine, cosine and tangent ratios. Trigonometry was very tricky, like its name. It was one of the many topics I loved in mathematics. Trigonometry was tricky for others but not for me. I used to practise mathematics every single day with my friends and I had trained myself to think critically. I was not lazy to think and that made it easier for me to succeed in topics such as trigonometry, geometry and factorisations.

Understanding mathematics helped me a lot in subjects such a computer science and physical science. Physical science has many calculations, which requires one to know his or her mathematics very well. My physical science teacher used to say that mathematics and science learners were different from other learners. He used to say that we were better than all other learners, who were doing commercial subjects. I remember one learner in our class entered a beauty contest at school and did not make it to top 10. Our physical science teacher then said to her, “What were you doing there? Contests are for learners doing commercial subjects because they have nothing important to do. You, as a science learner, should be focusing on important things like mathematics and science.”

Many more excursions were organised at our school for mathematics and science learners than for commercial subject learners. There was a division at school between learners, who were doing mathematics and science, and learners, who

were doing other streams like commerce or visual arts. Commerce and visual arts learners used to call us nerds. They would mock us, saying we carried big bags as if we are selling tomatoes. They would also complain about the trips that we had. We also laughed at them and said that they were doing useless subjects and fake mathematics because society had made us believe that mathematical literacy and commercial subjects were not as important as mathematics and science subjects. Every time you told a person that you were doing mathematics and science, people looked at you and started to respect you. When they looked at you, they saw a genius. Our school also made mathematics and science subjects look more important than other subjects. Learners who were good at mathematics and science were taken very seriously and many opportunities opened for them.

I also remember that it was in my 10th grade when I started to attend the Star School Incubator Programme. One morning when I arrived at school, I heard someone calling me and asking me to hurry up. It was about 7:30 in the morning and a teacher was looking for me. He was selecting five learners to attend a programme called the Star School Incubator Programme. The selection was based on our grade 9 mathematics results. Again, the 66% I got in grade 9 gave me the opportunity to attend the Star School Incubator Programme. This is a programme that allows different organisations to sponsor learners who are selected from under-resourced schools in the communities where they live, as part of the Corporate Social Investment Portfolio. Only learners who did mathematics and science could attend. The programme took place in Braamfontein at the University of Witwatersrand, every Saturday.

I still remember the first day I attended the programme. I was sitting at the back with my friend Lerato. The lecture hall was packed with different learners from different schools in Tembisa. All those learners were identified by their schools to be the best learners in mathematics and only the top five learners from each school were selected to attend. In our class, there were only learners who attended schools in Tembisa. Other classes had learners from other communities. Only three subjects, mathematics, science and English, were offered by the programme. Each subject lesson was an hour and a half. On our first Saturday, we wrote baseline assessments for all three subjects. I cannot recall how much I got

for English and science, but I remember that in mathematics I got 11 out of 100. "What an embarrassment," I thought. Imagine being selected as one of the top five learners who are good at mathematics and then you get 11 out of 100 for your first test! I hid my marks so no one could see them. I was scared that I had failed my test and other learners would laugh at me.

I was also thinking about how I had embarrassed my school and mathematics teacher. I was so embarrassed, until I found out that my marks were actually higher than everybody else's marks in our class. My friend got 3 out of 100. After I realised that my marks were the highest, I felt better. I did not feel better that I achieved the highest mark, but that I was not the only one who failed. I remember how much we laughed at each other. All of us laughed, even the lecturer. We were shocked at our marks because we were used to getting high marks. Mr. Pillay, an Indian man who was our mathematics lecturer, said, "Welcome to the real world of mathematics, kids. I cannot believe all of you failed." For me, it was the first time I had failed mathematics in my life. I was really shocked and disappointed and even though I laughed at myself, I was still hurt. There was this boy by the name of Xolani. Apparently, he was the top learner in his school with mathematics and science. For science, his marks were higher than all of ours. He was also very good with mathematics and even in the Star School Programme, he was very quick to understand concepts and his marks were great. After the first test we all performed well in the tests that followed. Xolani was my greatest competition. This boy killed mathematics. I think I intimidated him as much as he intimidated me because after every test we wrote, he wanted to know my marks. Though he was always the highest and I second, he kept asking about my marks. During the June exams, we both achieved 78% in mathematics. He could not believe it and to be honest, I did not believe it either. I was happy that I got equal marks with him. After that, I knew that if I worked harder, I would do better than him.

Talking of the Star School Incubator Programme, I remember one day in class Mrs Dlamini gave us a sum, a very challenging sum and none of us could solve it. She then looked at us Star School learners and said, "Star School is for stars. Let all the Star School learners tell us the answer." After she said that, all of us learners who were in Star School looked down, and felt so embarrassed that we did not

know the answer. We were expected to know everything because we were in Star School.

Later in the year, five other learners were selected for another programme called Dimension Data Saturday School⁴. Dimension Data Saturday School is a programme that also aims to improve learners' science and mathematics results. Learners who attended this programme were also selected based on their mathematics results. The school also offered extra classes for mathematics and science subjects as compared to commercial subjects. There was a competition between Dimension Data learners and Star School learners in our class. We all wanted to prove that we were not chosen by mistake to attend Star School or Dimension Data and that made us work even harder. As a result, we all achieved good mathematics results at the end of the year.

In the 11th grade, we had the same mathematics teacher as in grade 10. Mrs Dlamini was teaching both grade 10 and 11. It was better for us to move from one grade to another with the same teacher, who was knowledgeable. Furthermore, I was used to her style of teaching and her personality and so it was nice to have her as a teacher again in grade 11. I do not remember much about grade 11 except that, I started dating a grade 12 person who was liked by most of the girls at school. Until then, I was considered to be a good learner, who was not dating at school. My teachers loved me and were very proud of me until I started dating the matric guy. Most girls began hating me and our relationship was known by almost everyone, even my class teacher Mrs Modiba. During that grade 11 year, there was a lot of work to be done in mathematics. Mrs Dlamini decided to have extra classes in the afternoons, but that was the time I used to see my boyfriend. I decided that I was not going to attend the extra classes. I only attended the classes twice. One day in class, my mathematics teacher shouted at me, asking why I was not attending. She already knew that I was dating a grade 12 boy because the other learners had told her. She said, "Ntombi," as she always said when we had done something wrong. The moment she said Ntombi, I knew that she was about to stop the lesson and talk about me. I felt that she talked too much but she gave good advice. She told me that I was going to fail mathematics

⁴ **Dimension Data Saturday School** is a two-year programme that benefits one hundred 11th and 12th grade learners from 21 public secondary schools in Gauteng.

because of a boy and threatened to call my parents to school and tell them that I was dating at school. I was also called to the office and told to stop dating the grade 12 boy because he was going to disturb my performance. He was not called to the office; only I was called, as if I was alone in this dating thing. I recall asking my mathematics teacher why they were disappointed in me and not in the boy. Her reply was that I was a girl and he was a boy, so I was the one who was going to fall pregnant and not him and that I should stop dating him and focus. I was told I could not cope with dating and academics at the same time. I was angry and I remember asking the teacher why boys were always allowed to get away with anything but not the girls. She just said, "It is because you are a girl and as a girl you should take a good care of yourself so people can respect you." She added, "*Ayikho indoda efuna umuntu onomtwana. Ngeke bakushade mawuse unomntwana wenye indoda,*" meaning that men did not want to get married to girls who already have children with other men.

During the June exams, I asked my friends who I practised mathematics with to help me with the things they had learnt in the afternoon lessons. They helped me and I found that they were doing surds. Surds are irrational numbers that are left in root form to express their exact value. My friends showed me almost everything they did in class and I practised mathematics with them. We wrote our first paper and I passed with very high marks. The teacher announced the results in class. Everyone had achieved marks lower than 60% except me and my other two friends, who also got above 70%. I had achieved 87% for the exam. When Mrs Dlamini called out my name to come get my script, she did not know it was me. She used to call me maMsibi, so she did not know my real name. I stood and the moment she realised it was me, she was shocked and said, "*Whoo! Ima kancane.* This cannot be your script". The phrase "*Whoo! Ima kancane*" is translated as "Stop! Wait for a moment." She did not believe I achieved those marks, and even my classmates expressed disbelief, except for the two learners who had practiced with me. I can still remember that moment as if it happened yesterday. The teacher accused me of cheating. She said that maybe there was a teacher who gave me the question paper and I cheated. I tried to explain myself, but she would not listen. My friends also explained to her that they were practising mathematics with me, but she was still in denial.

She took my script to the HOD and they decided that I should write again. The HOD said that she should set a question paper and let me write it. If I failed, then it meant I had cheated, but if I passed, they would believe me. The teacher was very angry with me for nothing. I was very hurt and angry because now my classmates started calling me names, saying I was a cheater. One boy even said that all this time I was getting high marks maybe I was also cheating. I went home angry, but I told myself that I would practise mathematics and make sure that I showed this teacher that I did not cheat. The next day they took me to the staffroom to write. I wrote. The paper was very difficult; she had made sure that she set a difficult paper, but I was okay with it. I managed to write it and I passed. I achieved 92% and that proved to her that I did not cheat. She gave me an apology.

A few weeks later, we wrote a test out of 25 marks. The test was based on transformation. Transformation is a process by which an object is changed into another one of the same value. There are four types of transformation namely:

1. **Translation:** an object is moved in space without changing its orientation or shape and size.
2. **Rotation:** an object is rotated either in a clockwise or anti-clockwise direction without changing its size or shape.
3. **Reflection:** An object is flipped across a line called axis of symmetry without changing its shape and size
4. **Dilation:** An object is contracted or expanded without changing its orientation or shape.

For the test, I achieved one out of 25. People laughed at me. We had to draw the images of the original objects and label the points of transformation. I drew the images but forgot to label them. The images were correct, but I was penalised for not labelling the points. It was funny. I could not believe it. Just after giving me my script, the teacher said, "*Ntombi. We maMsibi. uyabona umjolo? Abafana benzana so.*" She meant that I had got one out of 25 because of dating. MaMsibi was the name she gave to me, which meant Mrs Msibi. Msibi was the surname of the boy I was dating. Learners laughed at me. Even today, one of my friends still laughs at me when she thinks of that day. It is funny when I think of it. I made a stupid mistake. The test was out of 25 and everything I did was correct, except that I did

not label my points. I do not think I was the only one who did not write the points. There were many other learners who did not write the points but did not get one out of 25. So why was I the only one who got one? This concerned me. Maybe I was penalised because she wanted to prove that boys would make you fail or maybe it was because I deserved to be penalised, only she knew. Luckily, the test did not count for marks. It was just an informal test that she used to check how much we understood with regard to transformation geometry.

Around the 4th term, my friends and I attended an event at the library. They were talking about careers and their requirements. I wanted to become a chartered accountant or a mathematician, and my friends wanted to do information technology, electrical engineering and geology. As we were listening, we realised that all the careers we wanted to do required that we achieve good grades in mathematics and English. One man mentioned that we needed our grade 11 report cards to apply for tertiary education. He explained how important our grade 11 end-of-year results were. From then on, we started practising mathematics more. We collected past exam papers for all our subjects and studied in the afternoon. Star School materials for mathematics, science and English helped us a lot. We used them to revise for the exam.

One day during a mathematics period we were revising for our exam. Most of my classmates kept coming to me to ask for help. I then decided to stand up and teach them. I became a teacher for that day and we were going through a past exam paper. Our mathematics teacher looked at me teaching and then suggested that I study teaching. She said that I would be a good mathematics teacher. I enjoyed teaching and seeing my classmates happy because they understood. There were some topics that our teacher had taught us that we could not understand, but when a learner stood up and taught us, we understood. I used to teach my peers regularly. I started when I was very young, as I said earlier in my narrative. At the end of the year, we all progressed to grade 12.

Mathematics in grade 12 was a challenge. We had a female teacher, Ms Mashiane, teaching mathematics in grade 12. Her personality and style of teaching was way different from the grade 11 teacher. She was more reserved

and quiet compared to the teacher we had in grades 10 and 11. She was also very good at mathematics and had been teaching grade 12 for as long as I knew her.

One of the most challenging topics for me since Grade 10 was financial mathematics. In grade 12, it became even worse because we were introduced to future investments and loans. That confused me. I did not know when to use the future investments formula and when to use the loan formula. The English that was used in financial mathematics was too much for me. I did not understand most of the instructions given and as a result I performed very badly in financial mathematics. My grade 12 teacher spoke in English and Sepedi most of the time. There were terminologies I did not understand and she did not really explain to us what they meant, unlike in grade 11, when our mathematics teacher would give us notes and explain them in the language that we all understood. I do not remember getting any notes in grade 12 mathematics. Instead, the teacher did many examples to explain a concepts in financial mathematics such as annuity, present value annuity, future value annuity, and nominal interest rate.

Term	Meaning
Annuity	A number of payments that are equal and made at a fixed intermission for a certain amount of time.
Nominal interest rate	An interest rate that is compounded more than once in a year.
Future value annuity	The same amount of money is paid regularly into a savings account, so we may have money in the future. It earns a certain rate of compound interest.
Present value annuity	regular equal instalments are made to pay back a bond or loan over a given amount of time.
Simple interest	It is calculated on the principal amount of loan.
Compound interest	It is calculated on the principal amount of loan and also on the interested accumulated in previous period. It is interest on interest.

Table 3: A table showing financial mathematics terms and their meaning

These terms made my life a living hell. I did not know which formula to use because I never understood the scenarios they gave us. Therefore, every time I wrote a mathematics paper, I would skip the financial mathematics section, do the other calculations and when I was done with other topics, I would come back to financial mathematics.

In contrast, the topic I loved so much in grade 12 was differential calculus. Differential calculus cuts something into small pieces to find how it changes. Many people struggled with calculus and found it difficult, but I enjoyed it and thought it was easy. My mathematics teacher told us that anyone who was going to get a distinction in mathematics in the final exam would receive one thousand rands from her. That motivated us to practise mathematics. In matric, we attended morning and afternoon classes. The workload was hectic and I had dance classes to attend in the afternoon. It was compulsory for every learner to attend the morning and afternoon mathematics classes, but I did not attend. My father told the school that I was not going to attend any of the afternoon sessions because he wanted me back home immediately after school. The principal explained that it was the government that suggested we attend the classes and I remember my dad telling the principal that I was his daughter and not the Department of Education's daughter. The principal did not argue with my father; she just did as my he said. I did not attend any afternoon sessions and skipped many morning classes too. I was excited with the decision my dad took. Attending from 7am until 7pm did not make sense to me. I did not want go back home after school tired and with a lot of homework to do. I was the only girl and my dad wanted me back home to come do house chores because I am a "girl". In 2009 when I was in grade 11, I moved from my grandmother's house to go live with my dad who paid lobola for me so that I could live with him and my two uncles. My youngest uncle was not working. He was the last born from my grandparents.

Therefore, every day when the school ended, I would take a taxi and go to a dance rehearsal. I was part of an arts organisation formed by my father. We rehearsed every Monday to Friday from 16:00 to 18:00. Every day after rehearsal, when I got home, the first thing I did was house chores and cooked for the family. Sometimes my uncle would cook and leave the dishes for me to wash. My father

did not like the idea of my uncle cooking, as he believed that as a girl, I should be the one doing the cooking and cleaning of the house. I remember one day I was very tired and having a mathematics assignment to do. My father told my uncle to never cook again. He said, "Diketso do not cook again in the house. Dorcus will cook. She is a girl, so she must clean and cook. Not you." My uncle tried to reason with him by telling him that I came back late from rehearsals and had to study since I was doing matric. My father said that I was not the first person to do matric in the house. They all did matric and when they were in matric, they still did their chores at home. My father believes in Pedi cultural traditions and whatever he says goes.

I always finished doing the household chores after 9 o'clock at night, then I would go to my room to study. Most of the time I could not study because I was tired, so what I did was to sleep first and wake up at 3 o'clock in the morning to study. Sometimes I would sleep and never wake up. I had a dilemma. I loved to dance, so there was no way I would stop it and focus on my books. Yes, I wanted to pass my matric with flying colours and get a distinction in mathematics, but taking a break from dance was the last thing on my mind. In grade 12, I even stopped practising mathematics with my friends because in the afternoon I always rushed to attend rehearsals. My father knew that school ended at quarter past two, so, he would calculate time. He waited until it was 3 o'clock. If I was not back at home at 3 o'clock, he would call and shout. Therefore, I always had to be on time or lie to him and say I was writing a test or assignment, so that I could get time to practise with my friends.

It was in 2010 and everyone was in a soccer world cup mood. Our organisation was invited to perform at Welcome Village as part of the many events taking place that year. In addition, teachers were on strike in the very same year, 2010. We almost did not write our final exams. I remember we had to put a lot of effort in our academics, so that we could pass. I had to balance many things in grade 12. During the teachers' strike, most learners in Tembisa went to one school where they taught themselves. They did past question papers for mathematics and physical science. While they were busy studying, I was busy with my dad, performing. I wished I could join my peers, but my dad would not agree, therefore,

I did not even bother to ask him because he was very strict. Sometimes when I asked him to attend extra mathematics classes, he would say, "I will teach you mathematics myself. You do not need to attend extra classes." Therefore, I practised by myself and it was challenging because there were things I did not understand.

During final year exams, I studied under difficult and stressful conditions. My dad used to drink alcohol. Whenever he was drinking with his friends, they would play the music so loudly that I could not even focus. If it was not my dad playing music, it was the neighbours. I had to teach myself to focus and study regardless of how loud the music was. The street I lived in was a very busy street. Children were running around making a noise and there were taverns on every street corner. There were two taverns nearby our house. One was just opposite our house and the other was three houses away from our house. The music was playing day and night. Weekends were the worst days, because people were not working. Sometimes while I was studying, I would hear a gunshot and get terrified that my dad was not in the house. I would stop studying, go and stand by the window, and open a curtain so I could see what was happening outside. From there, I would just go straight to bed. Sometimes my father would leave me alone in the house and be gone until the following morning. I had to take care of myself. It was hard and I did not have enough time to study. Sometimes I would use candlelight to study because we did not pay for our electricity.

While I was busy trying to advance my academics, someone stole my calculator the day before we wrote our mathematics exam. I searched for it and asked my classmate, but no one had seen it. I had to ask people to lend me a calculator because I could not find mine. I went back home and while I was searching in the house, I came across a business calculator. I took it and tried to use it, but I was just wasting my time. I could not do financial mathematics with that calculator. It was not for grade 12 mathematics. I even tried using it during the exam and it gave me wrong answers. I could see that my answers were wrong but I could not change them because of time. I was greatly stressed during the exam to a point that I skipped a question by mistake and it comprised a lot of marks. After the exam, I asked my friend to lend me her calculator because I wanted to check my

answers for financial mathematics. I checked and found that indeed my answers were wrong. The steps were correct, but the answers were wrong and after that, I was stressed for days. The first thing I thought of was if I was going to meet the requirements for the career choice I had applied for at the University. I had applied for actuarial science, financial accounting and dramatic arts at the University of Witwatersrand, so, I was really stressed. For about a week, I could not focus. I was sad and disappointed in myself. I do not even know why I was disappointed in myself. I kept blaming myself for losing my calculator. I also thought to myself that if I had taken a break from dance and focussed on my academics, maybe I would have done better. However, regardless of all those challenges, I was able to write and pass my matric with a B symbol. My marks were pleasing, though I think I would have achieved better results if I had lived under more favourable conditions.

My marks allowed me to be accepted at the University of Pretoria to study Bachelor of Commerce in Financial Mathematics, and Bachelor of Education. However, I took a gap year in 2011 after I passed matric because I did not have money to attend university. My father tried to find a scholarship for me to study the performing arts but I had no interest in the performing arts. I loved it, but I did not want to do it as a career. All I wanted to do was anything associated with mathematics or that would allow me to work with numbers. So, I applied again for the year 2012 at the University of Pretoria. This time I applied for actuarial science as my first choice and computer science as my second choice. Along the way, I decided to change and do education. I went to sleep one night and woke the following day filled with love for education. I remembered my mathematics teachers, including my mother, and the impact they had in my love for mathematics and I decided that I wanted to follow in their footsteps and help children, who come from a disadvantage background like me, to do well in mathematics. I wanted to take my love for mathematics and pass it to our disadvantaged learners. Today I am a teacher at a disadvantaged area in Tembisa, helping learners to do well in mathematics.

In the next chapter I interpret and analyse my narrative

5. CHAPTER 5: ANALYSING AND INTERPRETING MY AUTOETHNOGRAPHY

5.1 INTRODUCTION

In chapter 4, I have presented my story. I narrated about my lived experiences learning mathematics as a Black female in South Africa. In this chapter, I analyse and interpret my narrative. An autoethnographic study is interpretive at every phase, from the conceptualisation of the study to the collection and generation of the data and writing of the narrative (Josselson, 2006). While I was writing my narrative, I was already analysing and interpreting it (Jarvis, 2014; Lewis, 2019). The analysis of an autoethnography is not separated from data collection, because while I was writing my story, I was also thinking about it analytically (Chang, 2008; Jarvis, 2014; Lewis, 2019).

Ellis, Adam and Bochner (2011) postulate that the purpose of autoethnography is to narrate and analyse personal experiences in order to understand the societal and cultural context in which it occurred. Data analysis includes interpretation, which in turn impacts on our choices or depictions of stories (Hunter, 2010). Analysis and interpretation work in collaboration; we analyse narrative data with the purpose of developing an understanding of the meaning that we give to ourselves, our lived experiences, our background, and to our lives through storytelling (Jeong-Hee, 2015). In an autoethnography, the emphasis is on making use of the personal experiences of the researcher in order to interpret elements of the social world in which he or she is rooted (Ellis & Bochner, 2000). Hence, in autoethnography, the link between the researcher's various identities as a researcher and as a participant in a social world creates an important part of the observations that are then analysed.

The approaches of analysis that are used in my autoethnographic study combine two elements: self-analysis and cultural analysis. These two elements have been defined in terms of paying attention to personal experiences and zooming out to broader cultural perceptions and contexts (Chang, 2008; Ellis & Bochner, 2000).

In this chapter, I make use of narrative analysis to provide in-depth thinking about my narrative in order to obtain a more profound and philosophical understanding of my lived experiences (Jarvis, 2014; Lewis, 2019). Narrative data analysis assesses the writer or speaker who gave the information, asking what their narrative/story says about them, as well as what it says about the subject of the study (Bamberg, 2010). According to Jarvis (2014), narrative analysis is built upon the grounds that a good story is theoretical in itself because when a person tells a story, he or she uses analytical methods to understand his world. Through my narrative analysis, I attempt to explain what happened and why it happened in a specific manner. The following themes emerged from my narrative, namely, support from parents, family, peers, and teachers; Blackness and mathematics; gender and mathematics; mathematics and resilience; hedonism; and, self-liberation and self-discipline.

5.2 SUPPORT FROM PARENTS, FAMILY, PEERS, AND TEACHERS

Parental support positively impacts their children's education at all age levels. Ruholt, Gore and Dukes (2015) have shown that involvement of parents in the education of their children not only contributes to higher academic achievement, but also to optimistic behaviour, meaning that learners who have supportive parents tend to achieve the best possible outcome from any given situation and never give up. They always focus on the positive side of things. Parents play a significant role in shaping how their children respect their scholastic work, because they can motivate children to flourish in an academic environment. Parents can also prevent their children from achieving their goals through the absence of concern for their schoolwork (Ruholt, Gore, & Dukes, 2015).

Education does not only take place at school but also at home (Jiang, Ekono, & Skinner, 2016). It is both the teachers' and the parents' responsibility to nurture the education of children. My narrative describes my mother as the primary support in my mathematics development. In particular, my mother's interest in mathematics and her encouragement affected my attitude towards mathematics, my self-esteem, and my motivation from a very young age. Although she did not have a formal teacher's qualification, she became the primary source for to the development of my love for and understanding of mathematics from a very young

age. Through her support, I developed a positive behaviour or attitude towards mathematics. I became confident to deal with mathematical problems even before I went to primary school and was later selected to do mathematics at secondary school. Through her play method, she laid a solid foundation for my mathematical knowledge.

My mother's support was also complemented by my primary and secondary mathematics teachers. As I was writing my narrative, I realised that my teachers played an important role in nurturing my sense of belonging. This influenced my feelings about mathematics and how much I value it. My second-grade teacher was also a significant support and motivation in my love of mathematics. Her love and support towards all her learners had a positive impact on my mathematical success. She created a positive atmosphere for mathematics learning by making us love being at school and feeling accepted and appreciated. Pedler (2018) states that it is imperative for educators to understand the value of belonging. A sense of belonging contributes to effective lessons that will support learners in the classroom, as well as in the school as a whole. According to Finn and Zimmer (2012), cultivating a sense of belonging in the classroom can support both learners' scholastic achievement and involvement. Learners who show high feelings of belonging in the classroom or school are normally more dedicated and motivated in their school work (Finn & Zimmer, 2012).

I have stated in my narrative that in grade 9 I did not have the best mathematics teacher, as she was often absent from class. Yet due to the support that I received from my mother, and the foundation that she and my primary teachers laid for me, I was able to achieve good results in mathematics. Sheldon and Epstein (2005) asserts that a high level of ability on mathematics test is linked to teacher and parental support towards children's mathematics learning. Children put more effort into their mathematics learning when they have parents and teachers who motivate, believe, and support them (Christenson, Sinclair, Lehr, & Anderson, 2004).

My narrative reveals that it was not only parental and teacher support that influenced me, but also my peers. Interaction of learners can significantly help a

learner's understanding of the concepts of mathematics (Din, Ayub, & Tarmizi, 2016). I had support from my peers. My friends shared their knowledge, information, and mathematics question papers with me. We taught and motivated one another to do better in mathematics. Together, we always aimed for higher marks. The support from friends also contributes to learners having more control over their own learning. In conclusion, I believe that it was the support I received from my mother, teachers, and peers that helped me to achieve success in mathematics. The involvement of my mother in my mathematics life helped me to understand and improve my mathematics performance.

5.3 BLACKNESS AND MATHEMATICS

The theme of Blackness and mathematics emerged strongly through my narrative. My Blackness was problematic and led me to live in poverty. In the racialized South African context, my Blackness did not shape an easy path for me within mathematics education. Research shows that Black learners and their abilities, more frequently than not, remain to be enclosed in negative and unfavourable ways (Martin, 2012). In the case of Black learners, failure and underachievement in mathematics are often accentuated over resilience and success (Martin, 2012).

My narrative displays that race is deeply embedded in my lived experiences as a Black female. In my narrative, race is highlighted through the environment in which I lived. As previously discussed, my personal experiences took place at Ivory Park informal settlement in Tembisa township a Black township within the South African spatial context. The context in which my lived experiences occurred was a product of the racial laws created by the social engineers of apartheid. Black, Coloured, and Indian people were ordered through legislation, such as the Group Areas Act of 1950 to live separately from one another. Furthermore, the Land Act of 1913 restricted Black South Africans from owning land in urban areas, such as Johannesburg.

The secondary school that I attended was in a Black township. The school had the minimal resources compared to traditional White schools. For that reason, additional lessons were offered by the Witwatersrand Star School.

My narrative reveals that I, as a Black learner, had to work extra hard and rely on my creativity. I found myself in an overcrowded classroom, sharing one chair with another learner. A mathematics class of more than 50 learners with no resources is hardly an environment conducive to learning, especially when equated with private and suburban schools where the average class size is 20 learners and resources are overflowing. In my narrative I highlighted that my mother made use of bottle tops to teach me mathematics.

Creativity had to take place in order for me to succeed in mathematics. In secondary school, there were not enough mathematics textbooks and learners had to share a textbook, which was a disadvantage because it meant that they could not take it home. The issue of race is prominent in my narrative through crime and violence in the schools and township. As a result of my Blackness, I found myself attending a secondary school in a place that was known for crime and violence. The ruthlessness of apartheid and discrimination and the demoralising outcome of racism were some of the factors that contributed to the violent crimes that were experienced in my township (Schonteich & Louw, 2001). There was a high unemployment rate, absent fathers, and the abuse of drugs and alcohol (Nggela & Lewis, 2012) in Tembisa, all of which contributed to violence and crime. It is my skin colour that placed me in a Black township where the level of crime was very high.

5.4 GENDER AND MATHEMATICS

There is a historical and societal deep-rooted myth that girls and mathematics are not compatible (Gholson, 2016; Githua & Mwangi, 2003; Joseph, 2016). My narrative highlights the relationship between gender and mathematics. Even though gender differences in mathematics achievements are likely to be small, these differences occur more considerably in the career choices of learners (Dey & Hill, 2007). There are still a minimal number of females in the mathematics and science-related fields, leaving an unequal numbers of women in low-paying jobs. Ganley and Lubienski (2016) assert that starting from a very young age, girls are more fearful and display less confidence in mathematics than boys. These disparities in anxiety and confidence are bigger than authentic gender differences

in the achievement of mathematics. These attitudes are vital signs of mathematics performance and career choices associated with mathematics.

In chapter 3, I highlighted the underrepresentation of girls in mathematics. My mother realised the importance of mathematics and knew that it would open educational and career opportunities for me. She regarded mathematics as a gateway subject for a Black female like me. This notion is affirmed by Samuelsson and Samuelsson (2016) who reason that gender and social class are often taken into consideration when learners are selected for mathematics.

Contrary to my mother and my female teachers, the male members of my family, such as my father and uncles, did not associate mathematics and science with females. My father did not believe in me doing mathematics because I was a female. He believed that females were good at biology but not at mathematics. My uncles objected to my mother teaching me mathematics instead of me doing house chores. This resonates with the research by Niederle and Vesterlund (2010) and the disputable perception that the mathematical performance of males is better than that of females.

The reaction of my grade 7 teacher, who was surprised by my performance, also strengthens the theme of gender and mathematics. She was surprised that I scored a higher mark than a specific boy in the class. When I was writing my narrative, I recalled that my grade 11 teacher made me rewrite a mathematics test because she did not believe or understand why I had achieved good marks when I had not attended her extra classes. This confirmed the perception that teachers, in my case female teachers, often have a lower expectation from girls than boys.

In my narrative, I also wrote about people who tried to talk me out of doing the mathematics and science streams in the FET phase (grades 10 to 12) because they believed that mathematics is difficult and if I took it, I might find myself failing. In research conducted by Humphreys (2015), it is shown that the majority of young and old women believe that subjects such as mathematics and science match male careers or that they are better fitted for the brains, hobbies, and personalities of boys. These societal perceptions about mathematics being well-matched with

boys are some of the reasons contributing to females running away from science and mathematics subjects. Exceptional performance by Black female learners is often associated with supernatural abilities. Hence, two girls accused me of practising witchcraft and cheating when I scored exceptionally high marks in mathematics.

Feminist researchers, such as Burton (2011), have produced sociological explanations for the male supremacy of education in general, and specifically of mathematics. The main explanations are the absence of female role models, sexual harassment in educational institutions, the domination of males in educational spaces, extensive gender stereotyping, the gendered nature of understanding, and gendered choices for different teaching, assessment and learning styles (Mendick, 2005).

When I wrote my narrative, I realised that the perceptions that society has about males being better than females in mathematics is not always true. I am a female and in every mathematics class I was in, I was always among the best if not the best learner in mathematics. I have topped a lot of males in mathematics tests and assignments. I have surprised a lot of people about my mathematics success as a Black girl. Yet, Robinson and Lubienski (2011) showed that female learners have achieved better grades than male learners in mathematics over the past four decades. These findings were also supported by Brown and Kanyongo (2010).

Clarification for the gender gap between girls and boys has concentrated on different factors. Traditionally, lower mathematics performance of female learners was explained as connecting to both the external and internal contextual factors, for example, lower apparent support for learning mathematics (Eccles, 2011). I achieved success in mathematics regardless of my gender, because I did not allow anybody or anything to pull me down. Through the love and joy I had for mathematics, I managed to excel in it as a female even when society did not expect me to. I had so much pleasure in doing mathematics. The next theme I discuss is a theme of hedonism, which is about the pleasure I had with mathematics.

5.5 THEME OF HEDONISM – PLEASURE

The theme of hedonism is another theme that arose from my narrative. The term hedonism derives from the ancient Greek, meaning “pleasure” (Moore, 2004). Pleasure is broadly understood as comprising or containing all enjoyable experiences or feelings of gladness, contentment, love, joy, exultation, relief, delight, satisfaction, exhilaration, ecstasy, liking, gratification, elation, tranquillity, enjoyment, and euphoria (Moore, 2004). However, pleasure is also a personal emotional state experienced as worth seeking and a condition that is nourishing, and more than biological drives or basic needs (Damasio, 2003).

As I was crafting and thinking about my narrative, I asked myself what motivated me to continue doing mathematics when a lot of other females were discouraged and dropped out. I realised that one of the reasons I never gave up was based on the pleasure that I derived from learning mathematics. According to (Smith, Mahler, Pecina, & Berridge, 2010) happiness, as a sentimental characteristic, calls for continuous high self-efficacy, which puts together confident knowing and good feelings about what one is doing. He further suggests that by choosing mathematics, people prompt something about themselves, which is seen as positive. By replicating a mathematical identity, they develop pleasure, and hence happiness. I was excited when my mother taught me mathematics for the first time. I had so much pleasure in learning mathematics from a very young age, and I enjoyed every moment of it, both informally at home and formally at school. The support from my mother and teachers motivated me to love and enjoy mathematics while other learners felt pain and anxiety about the subject.

Pleasure is often associated with success (Smith, Mahler, Pecina, & Berridge, 2010). The pleasure I had in doing mathematics resulted in me achieving success. My love for mathematics made me not to be just good at mathematics but it made me faster at finding solutions to mathematical problems. The four operations of mathematics, namely subtraction, addition, division, and multiplication was not problematic to me. I enjoyed doing complex mathematics problems because of the happiness and satisfaction they gave me. I did a lot of mathematics as I was growing up.

I had an intrinsic motivation to practise mathematics almost every day. In all the subjects I did at school, there was no subject I enjoyed more than mathematics. The satisfaction and enjoyment that I experienced were not due to the teaching methods or the concepts that we learned but it was because I could relate myself to the process of solving mathematical problems. Not only did the good results in the subject provide me with satisfaction, but it was the fun that I had with mathematics and the ability to apply different problem-solving methods. Moreover, I enjoyed the praise I received from my mother and teachers after I had solved a complex mathematical problem. This encouraged me to do even better. With this enthusiasm, I did not experience mathematics anxiety that has turned out to be a norm in traditional education. In contrast, when I saw a formula, I did not react with fear but with passion.

I loved my mathematics teachers because of the energy they had when teaching the subject. It was only my grade 9 mathematics teacher who made me not enjoy mathematics because he never enjoyed it himself. He never came to class for many of his lessons and I believe that his absence during lessons affected my results. This made me realise that our attitude towards a subject and subject teacher has a great influence on how we perform in a particular subject. According to Khan and Jumani (2008), when learners are keen and interested to learn a particular subject, they produce better results compared to when they are not interested. Subject-specific interest is a significant determining factor for advanced learning and achievement (Hidi & Renninger, 2006). Tracey (2002) says that learners are likely to report high abilities and high levels of achievement when they are interested in their learning activities and tend to choose subjects that are linked to their interest.

I took great pleasure in doing mathematics and transcending my situation and being better than learners who thought they were better than me. My attitude towards mathematics, a subject that many people perceive as being difficult, has been positive from the first day I learnt it and because of that positive attitude I managed to be resilient and overcome many obstacles and achieve success. I never gave up in mathematics because of the love and joy I had in doing it and in receiving praises from my teachers and friends when I did well.

5.6 MATHEMATICS AND RESILIENCE

Resilience is associated with the ability of learners to deal with adverse conditions and challenges during the process of learning. Resilience is the ability of a person to oppose and react positively to undesirable situations that are unavoidable, and to take advantage of those undesirable situations into an opportunity for self-development (Singh, 2005; Maddi & Khoshaba, 2005). The lack of resources can often lead to bad experiences for learners (Hutauruk & Priatna, 2017). My narrative reveals my resilience to persevere and succeed under difficult circumstances.

Through every obstacle I faced while growing up, I did not give up doing well in mathematics. My narrative describes a small one-room shack, which I shared with eight other people, who included my grandmother, mother, aunty and five uncles. There was not enough space for me to do my schoolwork, but I still managed to work and achieve better results in mathematics than my peers who were better off. I also mentioned in my narrative that at home we did not have electricity. While other learners had electricity in their homes, I used to practice mathematics using candles so I could see at night. I did not allow my unpleasant conditions at home to have a negative impact on my mathematics learning.

Confidence is one of the seven domains of resilience (Reivich & Shatte, 2002). Self-confidence plays an influential role in the success of learners (Kunhertanti & Santosa, 2018) and contributes to the achievement of learners and their understanding of mathematical concepts and problems (Burton, 2004). In order for me to understand mathematics, I had to believe that I was capable of understanding and learning it. Mathematical confidence reproduces a growth mind-set and includes being prepared to take risks and endure (Dweck, 2006b). My mother and teachers prepared me to feel confident in my mathematical abilities as I was taking risks with new ideas and making mistakes. Because of this confidence, nothing stood in the way of my mathematical development. Mathematical confidence of learners has an impact on how they approach difficulties and failure (Dance & Kaplan, 2018). Learners who possess low self-confidence may make a mistake or fail and then label themselves by that mistake,

deciding that they are bad at mathematics. When they are faced with difficulties, these learners may develop anxiety and give up because they think they are not intelligent enough to figure it out. Learners who have mathematical confidence look at mathematical problems that are challenging in a completely different way than those with low self-confidence. For these learners with mathematical confidence, failure or mistake is seen as a chance to learn and grow. It is an opportunity for them to reflect and think about what they can do better next time. In my narrative I talk about a grade 11 mathematics class test about transformation geometry that I failed; I got one out of 25. I laughed at my marks after I received the test because I knew I had an opportunity to do better next time. I realised the mistakes I made in that test and I learned from them. I did not see myself as a failure because of that one test. At the end of the term, I passed mathematics with good marks.

There are several problems in the mathematics learning process, particularly in an effort to expand the mathematical skill to be attained. The challenges of learning and understanding mathematics are reasonable because mathematics requires learners to think deep and systematically, logically, in-depth, and with sober effort (Chukwuyenum, 2013). Therefore, a non-intellectual aspect of learning mathematics, which includes skills such as confidence, persistence, inflexibility, and understanding the role of mathematics in real life, needs attention. As a Black female learner, I have experienced times of difficulties in the learning process of mathematics. These experiences are certainly irreversible, but I managed to reduce their negative effects by developing resilient learning abilities (Glantz & Johnson, 2002; Schoon, 2006). I was persistent, unyielding, and confident with mathematics because I loved it and because my mother made it fun for me.

There are four correlated factors, as suggested by Johnston-Wilder and Lee (2010), that build mathematical resilience ability: the first one is value, which is a thought that mathematics is a subject worth studying and is treasured. In my narrative it is highlighted that my mother valued mathematics so much that she decided to be the first teacher to teach me mathematics. Then my primary and secondary mathematics teachers also valued mathematics and made it a point that some of us love and value it as well. I value mathematics because it is part of

our daily life. I believed that mathematics will provide me with a lot of opportunities. We live in a world driven by mathematics. When you have mathematics, people take you seriously and respect you. Without mathematics, there are certain courses you cannot do at tertiary level. Therefore, when learners think that mathematics is important to study they will be more motivated to learn and cope with all the challenges that comes with learning mathematics. My thoughts about mathematics being important motivated me to continue with mathematics till tertiary level.

The second factor is struggle. To struggle in mathematics is common for everyone, even for those who are labelled with having advanced mathematical skills. If learners were aware that to struggle with mathematics is a universal thing to do, they would accept it and remain tough when facing challenges with mathematics (Johnston-Wilder & Lee, 2010). There were times when I struggled with solving mathematical problems, but every time I faced challenges I went to my teachers or my mother and told them I was struggling then they would help me until I knew how to solve the problem. I accepted my struggles and as a result I was able to be strong and cope with mathematics.

The third factor is growth. This is a denial that there are people who are born without the skills to learn mathematics, but a belief that every human being is capable of doing mathematics. Some of the teachers I had believed that mathematics was only for males, and even my father had the same belief. Their beliefs and expectations for females were limited. Despite all these perceptions, I believed that mathematics was also for me (a female). I believed that mathematics was a subject like other subjects and everyone could do it and because of that I was able to develop tactics to overcome barriers in the process of learning mathematics.

The fourth factor is resilience, which is to respond positively when faced with negative circumstances or challenges in learning mathematics (Johnston-Wilder & Lee, 2010). In my narrative, I mentioned my grade 11 teacher who accused me of cheating in mathematics and I also spoke about female classmates who used to bully me about my ability to learn mathematics. These are some of the challenges

I faced when learning mathematics, but I chose to respond positively and not let anything pull me down.

5.7 SELF-DISCIPLINE AND SELF-LIBERATION

The number one characteristic that we need to develop in order to accomplish our goals in life is self-discipline. Self-discipline is a learned behaviour that not every child or young person has. Self-discipline is linked with learners' performance. Studies (Duckworth & Seligman, 2005; Laitsch, 2006) reveal that children and teenagers who have a strong sense of self-discipline, outperform their peers in terms of academic achievement. In actual fact, learners with strong self-discipline are known to have different behaviour, less absenteeism, and consistently do their schoolwork, in contrast to their less-disciplined peers. Self-discipline is not only associated with the academic performance of learners but also with how they behave.

Growing up in a disadvantaged area where the majority of people are unemployed, abuse drugs, are uneducated, and have poor access to resources, has an impact on how we behave (Whittle, Vijayakumar, Simmons, Dennison, & Schwartz, 2017). Such conditions can cause stress and has been associated with social and psychological problems in children and teenagers. Children growing up in disadvantaged families or neighbourhoods may develop stress because of limited access to resources, such as medical care and quality education, or because parents and adults in the community do not care and are less likely to look after children. Many parents are domestic workers, so they leave early in the morning to go to work and come back late in the evening. This means that they do not spend enough time with their children. As a result, many children and teenagers end up being rebellious, lose control, and fall into substance abuse. Only a few people growing up in such disadvantaged environments end up being successful. The majority end up dropping out of school and becoming parents while they are young.

In my narrative, I talk about my background. Growing up I did not like the situation I lived in and I decided that one day I would be a better person. I fought for a better future. I fought till I was able to rise above the steep obstacles in my path. Regardless of every negative thing that happened in my neighbourhood, such as

substance abuse, school dropout, and illiteracy, I fought for a better tomorrow. I liberated myself from poverty and illiteracy. I chose not to follow the crowd and focus on myself. I learned to discipline myself from a young age. I was born and raised by family members who have dropped out of school and abused alcohol. Many people in my family are uneducated and unemployed. I could have joined them in taking alcohol and dropping out of school, but I chose a different path.

During my teenage years, many of my friends fell pregnant. I was seen as someone who was dumb because I was not taking alcohol and running around with boys. In our township it was normal for a teenager to fall pregnant and abuse drugs and alcohol. Every corner in a township has a tavern and many of them do not have an age restriction. Therefore, young children miss school and go to the taverns instead. Over weekends, taverns are full of mothers, fathers, and young boys and girls abusing alcohol. Owners of these taverns make a lot of money. It was not easy for one to come out a better person in such surroundings. Many times, I was tempted to join the crowd and live my life like everybody else.

I highlighted that I started to misbehave during my teenage years, especially at the age of 15 when I was in my 9th grade. I skipped school and spent time at the park with friends and sometimes alone. I disrespected teachers and did not do my schoolwork. However, because of the discipline that I grew up with, I decided I was not going to play with my future. I went back to school, learned from my mistakes, and worked towards a better future and life.

Poverty sets a lot of young and old people up for lifetime of disadvantages (Headey, 2006). Children and young people growing up in poverty experience numerous difficulties, which accumulate through the life cycle. Poverty has numerous, undesirable influences on the outcomes of young people resulting to discriminations in psychosocial and cognitive development, health, and educational attainment (Hirsch, 2007).

Despite the context in which I grew up and all the challenges I faced during my mathematics education, I never stopped educating myself. My liberation from the poverty, crime, and teenage pregnancy that I experienced in the Black township, enabled me to do well at mathematics and I ended up attending the best

mathematics and science programmes, which positively affected my progress because I believed in myself. Many females did not believe in their abilities and ended up quitting mathematics. Not only did they quit mathematics but the majority of them dropped out of school before grade 12 or tertiary level. They had given up along the way, but I never did. I decided to stay positive and ignored all the negative myths by society about mathematics being difficult, and comments from people saying mathematics was for boys and not girls. I had to believe in my abilities and with the result I was able to pass my matric with a B symbol in mathematics, which allowed me to study mathematics for my teacher's degree at university. Today I am completing my masters.

5.8 CONCLUSION

In this chapter of my study, I have analysed and interpreted my narrative by reflecting on my personal experiences as Black female in South Africa. Through analysing my narrative I have realised that because of my Blackness I was only exposed to a chalkboard and textbooks during mathematics lessons, while other people had different materials to help them learn mathematics more easily. Because of my Blackness, I had to depend on my mother's support to do well in mathematics. In other grades, I was taught by teachers who were under-qualified to teach mathematics. The support I received from my parents, family, peers, and some teachers assisted me greatly in achieving success in mathematics. Without such a support system, maybe I could have given up along the way. The pleasure and confidence I had in doing mathematics helped me do very well in mathematics and consequently exposed me to better environments, such as the Witwatersrand Star School, where I was equipped by great teachers, who were highly qualified to teach mathematics. Also, through my resilience and self-discipline, I was able to do better than many females who also found themselves in similar situations of being taught by underqualified teachers and/or not having enough resources at school to do mathematics.

6. CHAPTER 6: CONCLUSION

6.1 INTRODUCTION

In this concluding chapter, I provide an overview of my study and the appropriateness of my research methodology, autoethnography. I further build on the analysis and interpretation of my narrative by answering my research question. In chapter 5, my analysis and interpretation emphasised how race and gender in particular, influenced the mathematics education that I received. It also highlighted the poverty of Black people caused by apartheid. I focused on the support that I received from my mother and teachers. Lastly, I discuss how my study contributes to the research field.

6.2 OVERVIEW OF MY STUDY

In chapter 1, I provided an overview of my study in which I analysed my personal lived experiences with mathematics education as a Black female. I centred the context in which this study is carried out. I have presented the rationale and motivation for my study by providing personal and professional reasons as to why I decided to conduct this study, and how it would benefit the field of research. In chapter 1, I also gave a brief overview of my theoretical lens, introduced my research methodology, and gave an explanation of how the data was collected and analysed.

In chapter 2, I discussed the importance of the literature review for my study. This chapter presented a solid foundation with which to understand why there are few females in mathematics. The literature review provided background information on my topic and strengthened and justified my research methodology (Ridley, 2012). The themes such as the power of mathematics, race and mathematics, gender and mathematics, culture and mathematics, and ethnomathematics were discussed. I concluded chapter 2 by discussing the theoretical framework that locates my study. I used feminism and Black feminism as my theory and obtained a better understanding of my lived experiences depicted in my narrative.

In chapter 3, I explained the research design, methodology and instruments that I used in my study to gather and analyse data. I used the interpretive paradigm, and motivated why I used it and how it related to autoethnography. I also explained autoethnography as a research methodology. The methods of data collected included self-interview and memory work, archival visits and records, critical conversations, as well as journals. Aspects such as validity and trustworthiness were also reflected on in this chapter, to ensure that the weaknesses and strengths of my autoethnography were carefully questioned.

In chapter 4, I presented my narrative in a form of storytelling. My narrative was divided into three parts, namely, story one, story two, and story three. Story one was about my life before formal school. Story two represented my first mathematics experiences. The last part of my narrative, which is story three, was about my experiences with mathematics education at primary and secondary school level. I believe my autoethnography is a clear, emotional, and personal explanation of my experiences. Telling my story connected me to my human race. It linked to my past, and provided me with a sight of my future.

Chapter 5 is an analysis and interpretation of my narrative. I have followed a narrative analysis method to analyse the research findings collected from the data. My analysis and interpretation focused on my involvement with mathematics education as a Black female learner. I analysed my narrative using the following themes: support from parents and teachers, Blackness and mathematics, gender and mathematics, hedonism, resilience, and self-discipline and self-liberation. I analysed and interpreted my narrative with the intention of developing and understanding the meaning that I give to my lived experiences, my background, and my life through the telling of my story (Jeong-Hee, 2015).

6.3 REFLECTING ON MY RESEARCH METHODOLOGY

Doing an autoethnography has brought various kinds of emotions to me. I was introduced to autoethnography by my supervisors. Initially, I was excited to do an autoethnography because it looked so easy. I felt that it was like doing autobiography and that I was only going to tell people about my personal experiences and include my interpretation. However, I discovered that I was wrong.

As an autoethnographer, I needed to move beyond the writing about the self (Denshire, 2014). I had to analyse my experiences in a particular context of the close culture. Culture is set in motion to understand how the self is located in the world, seeking a relationship between the self and culture.

One of the challenges that I encountered when I was doing autoethnography was to expose myself to the public, find my voice, and fully accept the methodology. Autoethnography is about making yourself vulnerable (Ellis, 2004). It displays your softness, strong points, deepest thoughts, and exposes you to the criticism of others (Forber-Pratt, 2015). At times I felt like I was standing naked in front of a crowd. However, I considered this methodology and made a vow to myself that I would take this route and complete my study, knowing that had I allowed my voice to be heard.

Autoethnography and writing about the self are often regarded as self-centred and subjective, lacking academic rigour. During the research process, I had to build rigour, credibility and trustworthiness into my study. Hence, I used various forms of data collection, such as memory work, archival visits and memory checking with family members, teachers and friends. The existing literature on autoethnography as well as the theoretical grounding further located my study in the academic domain (Creswell, 2013). Forber-Pratt (2015) posits that autoethnography is not for the faint-hearted. Starting a journey in a situation in which you have no skills or experience can be very challenging. I took this journey and was confident because of the assistance and inspiration I received from my supervisor and co-supervisor.

6.4 THE RESEARCH FINDINGS OF MY STUDY

In the previous chapter, I analysed and interpreted my narrative. This section of my study links my analysis and interpretation with my research question:

Why did I, as a Black female, achieve success in mathematics?

From the themes that have emerged from my narrative, I can say that the key findings of my study are parental involvement, teachers' support, self-discipline, discipline, and confidence. I have discovered that these aspects are vital for the

learning of mathematics and academic achievement. My narrative foregrounds the negative impact of race and gender within the South African context. My chances to be successful in mathematics were minimal considering the social and economic conditions under which I was born and received my mathematics education in primary and secondary school.

Being a female, I was subjected to the notion that Black females must do house chores. This perception of Black females was especially held by Black males. I was expected to fail based on my race and gender. This was confirmed by my fellow White male student when he was surprised by the good marks that I obtained in mathematics when I went to university.

I responded to the adverse socio-economic and educational conditions by achieving exceptionally high marks in a subject that was considered to be difficult and reserved for a few talented learners. The support I received from my mother from a very young age up until I completed my matric led to my success in mathematics. I believe that support plays a vital role in the academic achievement of learners. Having my mother as someone I could always go to when I needed help with mathematics was a blessing for me. It made me not give up in life. Her confidence and love for mathematics pushed me to be a better person and to take my mathematics lessons seriously. I believe that my mother and primary school teachers played a vital role in laying a foundation of mathematics in my life.

With this foundation I could build and rebuild anything on it. When learners have a strong foundation of mathematics, they can do even mathematics problems that seem too challenging in other people's eyes. It is significant for teachers to give a strong foundation to their learners and also for parents to support their children in their schoolwork. All higher level mathematics, courses build on the foundation phase mathematics skills. That is why it is so important for children to master primary school mathematics applications, concepts, and skills prior to learning higher level mathematics.

My teachers implemented differentiated instructions into the lessons, so they could meet all our needs and provide mathematical understanding. I have stated in my

narrative that my second grade teacher was one of the best teachers I had; she used different teaching methods, including songs and pictures to meet our different needs. They worked hand-in-hand with my mother to ensure a strong mathematical foundation that helped me even when I experienced poor teaching.

I also believe that my Blackness and gender had a great impact on my personal and professional life. Our experiences as individuals do not just happen outside of our social and cultural settings. They are informed by our historical, cultural and social contexts. I believe that my personal experiences with mathematics would have been different if I was born and raised in a different racial and social context. From analysing my narrative, I found that some of the challenges I experienced were informed by my Blackness and gender. However, I still achieved success in mathematics because I was resilient. Challenges and problems in learning mathematics can result in pressure and be a bad experience for learners. A resilient student is the one that is able to cope with the challenges they face in the learning process and end up succeeding. Doing mathematics without enough resources, and using a candle for light at night in order to practise mathematics can be very stressful for many children.

While analysing my story, I realised that had I not been resilient and stubborn, I was not going to cope. I struggled a lot during the process of learning mathematics. Being a Black female and doing mathematics in a world where many people think mathematics is for the elite, especially White men, is hard, because it means you have to work extra hard and ignore all these perceptions so you can achieve your success. I believe that if I paid attention to the low expectations that society has about girls and mathematics, and my family's beliefs about a female being a caregiver, I would not have achieved success in mathematics. Therefore, I believe it is important for one to have mathematical resilience.

It is not only the support that I received and being resilient that contributed to my success for mathematics as a Black female. I was also self-disciplined. I was exposed to a lot of things because of my social environment and the legacy of apartheid. When you grow up in a place where there is high unemployment, teenage pregnancy, alcohol abuse, and a high school dropout rate, you tend to

follow the trend and behave in a way that will lead you to failure. You end up abusing alcohol, and dropping out of school. You need to be self-disciplined if you want to become a different somebody. Being self-disciplined helped me; I believe it also impacted on my success. I know that for my examinations and tests, I practised mathematics even when there was a loud noise of people having a party outside. I chose between studying for my examination or joining the party. Studying for my exams was the better choice that I made.

I believe that if you trust in your abilities and love what you are doing, nothing will stop you from achieving your goals and dreams. My confidence and love for mathematics were influenced by the support I received from family, peers and teachers. They believed in my capabilities and motivated me to believe in myself. Confidence is a better predictor for learners' mathematical success than any other non-cognitive procedures (Stankov, Morony, & Ping, 2011). It acts in such a way that it overpowers everything else. Children must first realise that they have the ability to learn and understand mathematics in order to achieve success. There is a universal perception that understanding mathematics is an inborn ability. Carol Dweck (2006) disapproves of this notion. In her study, she states that individuals with a fixed mindset believe that our intelligence cannot be changed, but those with a growth mindset believe that intelligence can be changed through practice.

Teachers need to reinforce a growth mindset in learners so that they can develop a positive attitude towards mistakes, and be willing to take risks. To achieve success in mathematics, I had to be confident enough to try new methods, take risks and share my thoughts even when they did not match with others. According to Dance and Kaplan (2018), learners who believe in their abilities are not afraid to take mathematical risks because they know that if one strategy is not working, they can always try another. Therefore, it is important to help learners develop mathematical confidence that will enable them to achieve success.

6.5 CONCLUSION AND POSSIBLE FURTHER RESEARCH

This research dissertataion is an autoethnography in which I have shared my personal lived experiences with mathematics and mathematics education as a Black girl. My story is not mine alone, but it is also the story of others who share

the same experiences with me, as well as that of a society. The main reason for doing this study was to allow my voice to be heard. I wanted to share my experiences with the readers so that I can break the silence of the marginalised. While doing an autoethnography I came to a deeper understanding of my research process, as I was reflecting on my epiphanies about mathematics and mathematics education. Also, in doing this study, I have come to understand the meaning of my personal life, my experiences, and know my own story by applying an autoethnographic method. Autoethnographic study helped me to describe and interpret some of my positive and negative experiences within my cultural and social context. Sharing my story has been the most challenging, but pleasing experience. I shared my story so I can make a difference.

The opportunities for further research originating from study are related to the six themes I encountered while analysing my study: support from parents and teachers, Blackness and mathematics, gender and mathematics, hedonism, resilience, and self-discipline and self-liberation. I believe that more research should be conducted on how the above-mentioned themes result in mathematics achievement. I believe that perhaps we can have more women in the mathematics field if more research is done to prove that mathematics is not an innate ability. It would be great to have more females tell their stories about their experiences and success in mathematics.

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8. ANNEXURES

8.1 ANNEXURE A – LETTERS OF VERISIMILITUDE

8.1.1 Letter of verisimilitude from my mother – Nomvula Mlangeni

I am pleased to inform you that I have read the autoethnography of Dorcus. She has a beautiful story to share. I am a Nomvula Mlangeni, Dorcus' mother. I have raised my daughter together with a help of my mother, Thandiwe Mlangeni who is a grandmother to Dorcus. Dorcus has always been a very smart child with so much energy and confidence. At age 4 Dorcus was supposed to join her friends at pre-school but we could not afford the fees. The only person who was working at that time was my mother and she used that money to feed the whole family including my daughter Dorcus. So, I decided as Dorcus' mother that I will teach my daughter things by myself. I would not let her stay at home and be left behind alone while children of her age were getting education. I decided to start with teaching her mathematics which I believed was the most important subject to learn and it would open doors for her. I remember her telling me that she was part of the top five learners who were selected to attend a program called "Star School" at University of Witwatersrand because of her mathematics results. I was very proud of her. Her grade 9 mathematics results allowed her to take mathematics and science in Grade 10 to 12, she had met the requirements.

Dorcus is very disciplined and confident. Everything she put her mind to turns into something so great. I have been a proud mother from the day Dorcus was born till today. Dorcus have received awards at primary, secondary and also at tertiary for her outstanding academic performance. Today she is a mathematics teacher, and a master student at University of Pretoria. I am happy for my her I wish her all the best in her career path.

Nomvula Mlangeni

8.1.2 Letter of verisimilitude from my sister – Busisiwe Princess Mlangeni

Dorcus is my sister, very strict and disciplined. One word I can use to describe her is "Free-spirit". A free-spirited person has the same spirit as a wolf, and that is my sister. I use the inner wolf as an example of a free-spirit. A free-spirited person can thrive in all states and be all things. The inner wolf is not restricted by its physical conditions and primarily, bravery describes the inner wolf, and that is what describes the true free-spirit. My sister Dorcus hates to be tied down, she wants to run free. Nothing can stop her from achieving her goals. She has so much confidence and determination and that is what inspires me the most about her. She is a well-respected person and loved by a lot of people.

My sister and I are too different. I am a language person and she is a mathematics and science person. She excels in these types of subjects. It is always surprising to see a girl doing so great in mathematics and science. It is not normal. In our family only my sister and mom understands mathematics. I read my sister's story and was hurt to find out that my mother started teaching her mathematics when she was 4 years. Mommy did not do the same thing with me. She was always there to support me academically and help with math homework, but I don't remember her sitting with me and teaching me math. I am very bad at math and I hate it. Dorcus on the other side loves it and is very good at it. She was my tutor when I was doing grade 12. I never passed math from grade 8 to grade 12. The way I was so bad at math, every teacher at primary school used to compare me with my sister and that made me feel like I was dumb. Luckily I had my mom and sister motivating me at all times.

I believe everything she mentioned in her story because of what she said I know. I am motivated and inspired by her. I am in my second year at UNISA studying tourism management because I am inspired. Congratulations with her masters. I have so much love for her.

Busisiwe Princess Mlangeni

8.1.3 Letter of verisimilitude from my grade 2 teacher – Mrs Skhosana

I am very happy to know that I have had such a huge impact on Dorcus' mathematics success. As a teacher, I was just doing my job and making sure that my kids pass. When Dorcus visited the school so she can tell me about her studies, I felt so overwhelmed. I taught her in the year 2000. It is 19 years now and she still remembers me and my teaching methods. I am so blessed. Dorcus was a quiet, shy, yet very smart child. Teaching her was very pleasing because she was dedicated and her mother was very supportive.

I have read her story and I am happy that she is now doing her masters. Her story is very interesting and inspiring. I believe that it will motivate a lot of females to believe in themselves and pursue a career in mathematics because we need more females in the field of math.

Mrs Skhosana

8.1.4 Letter of verisimilitude from my grade 8 teacher – Mr Mcethe

I am a grade 8th teacher of mathematics. I taught Dorcus mathematics in 2006. I will never forget this child. As teachers we sometimes forget the students we taught because every year we receive new faces. However, there are some students that you will never forget as a teacher because of their character or of the impact they have had in your life. Dorcus is one of those students. She was very short and tiny, and full of energy and noise. She never stopped talking and was very naughty at times. I remember she gave me a name, “Co-interior”, after my lesson about alternating, corresponding, and co-interior angles. Whenever she called that name she would change her voice to be so tiny so people would laugh at me.

What I loved about her was that she always listened during my lessons and would pass all my mathematics tests. She loved mathematics and when I marked papers I always started with her paper because I believed that she would have written the correct thing. I am very happy to have had an opportunity to teach her. I am also happy that she identifies me as one of the best mathematics teachers she had. Her learners are blessed to have her as their mathematics teacher. South Africa needs such educators who have love and passion and who believe in their kids. I hope that by sharing her story, other people will be encouraged to also share theirs. I am proud of her and her achievements.

Mr. Mcethe

8.1.5 Letter of verisimilitude from a friend – Innocentia Khumalo

I am Innocentia Khumalo. I acknowledge that I have read the autoethnography of Dorcus Mlangeni. I am happy for her. I agree with what she wrote on her narrative. I remember how we used to seat and practice mathematics together with Dorcus. Dorcus has always been a mathematics guru. Every time when there was mathematics problem we struggled to solve, we asked her to help us and she would work on it until we find the correct answer. Mathematics is one of her favourite subjects.

I thought that she was going to study mathematics at tertiary and become a mathematician but she chose teaching, and majored in Mathematics. We have shared great moments with Dorcus from primary to secondary school. We attended the same primary and secondary school and shared some of the classes together. From the 10th grade I was in the same class with Dorcus and other friends of ours.

A moment that I will never forget was when we were about to write a math test in grade 10, and our teacher said, "The test is out of 10, trust me no one will get a total mark. In fact, nobody will get a mark above 50%". When she said that, Dorcus looked at her and said, "I will get a total and prove you wrong". She was so confident when she said that and she did get a total mark. She is one person who believes that mathematics is easy and everyone can do it. She is such an inspiration to me and I am happy she is my friend.

Innocentia Khumalo

8.1.6 Letter of verisimilitude from a friend – Ntombi Masango

I have read the narrative of Dorcus and I concur with what she wrote.

Meeting this lady is a blessing. I needed a person like this in my life. Whenever we were in class she would make solving a math problem easy and worth a try. Not a bragging type but the one that tells you to try again you will get it. She would always work for the best, be exams, tests, or assignments. I used to see her as my primary tutor. Dorcus is an independent lady when it comes to owning responsibility, thus she made it a point to overcome any challenges. In that way, I myself was inspired and motivated to carry on with math subject. Miss Mlangeni loves mathematics and always made sure she understood it. In a way it had a good influence within me together with friends of ours. Whenever she had questions she would have a better approach to reach a better understanding and will share with peers.

We had practice sessions with some of our friends and peers where we shared ideas and helped each other and Dorcus was always willing to help and felt really good about helping others. I could tell with the joy she had whenever I shared my results with her after she helped with my assignments and other mathematics assessments.

She was patient enough because she loved seeing others doing well with mathematics like she did. I have great wishes for her in future. The learners she teaches must be falling in love with Mathematics already.

Ntombi Masango

8.1.7 Letter of verisimilitude from a friend – Refentse Selepe

My name is Refentse, Dorcus is my friend. She is a fun person, full of jokes and never stops to talk. Dorcus talks too much, I am not surprised she is a teacher today. She always portrayed the qualities of a teacher in high school. She is a people's person; almost everyone at school knew and liked her. I have been classmates with her since grade 8. During our grade 10 year, Dorcus was dating this other boy and the whole school knew about it including the teachers. So what happened was she got highest mark on a math test and our math teacher was surprised and said to her, "Ntombi!! Kanti uyaphasa. Uyeke ukujola uzothola 100%. Meaning that "Girl!! So you pass, stop fooling around with boys and you will get 100%". That is how good Dorcus was with mathematics. Boys or no boys, nothing distracted her when it comes to her school work. She was not just my classmates but also my study partner. We attended Star School and shared mathematics ideas together. It was always nice to work with her.

Another incident I will always remember with Dorcus was when she got 1 out of 25 for our informal test. Everyone laughed at her as she was always expected to get highest marks. So when she got 1 out of 25, we were all shocked and we just laughed, including our mathematics teacher. That did not destroy Dorcus' self-confidence. She came back so hard and got a distinction on our next test. I love her and I am happy that we are still friends even after secondary school.

Refentse Selepe

