Evaluating a mathematics tutor programme for unemployed youth in a rural context

by

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Co-supervisor: Prof Sonja van Putten

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Declaration

I declare that the dissertation, which I hereby submit for the degree for the degree 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 higher education institution.

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Mariana Annalien Strydom

20 September 2023

Ethics clearance certificate

FACULTY OF EDUCATION
Ethics Committee

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Dedication

I dedicate this study to my husband, Ettienne Strydom, for his never-ending encouragement and support during my career since the day I met him.

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I did not do this study in my own strength, but God was all the while effectually at work in me (Philippians 2:13).

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Abstract

The most vulnerable youth in South Africa are aged 15–24, with only one out of three young adults working. Another predicament unemployed youth face is the poor mathematics education they rely on to prepare them for their future careers. This rationale motivated the implementation of a mathematics tutor programme at a rural school in Mpumalanga. Unemployed youth who passed mathematics in Grade 12 were trained and assisted as mathematics tutors working with small groups of Grades 4 and 5 learners. This study conducted a qualitative evaluation by investigating and describing the programme's meaning through the tutors' eyes. Social constructivism was used to develop a focused conceptual framework for tutors' key participation experiences. The study adopted a qualitative methodology and layered case-study research design. The already accumulated data were studied "in arrears" (post-hoc) through document analysis, and thereafter, the data which was still needed was collected through semi-structured interviews and questionnaires and thematically analysed. The study revealed that tutors' mathematical knowledge and understanding of valuable subject content improved. They acquired essential teaching skills and experienced positive personal development. The tutor programme can be refined by incorporating it as part of an academic curriculum for teacher education. Other similar tutor-based interventions can allow young adults who participate in the interventions to study teacher education while gaining practical experiences. Their practical experiences can expose them to mathematical and pedagogic content knowledge to teach mathematics. Their personal development can prepare them for the workplace, provide guidance on future career choices, and contribute to their social and emotional development, adult development and social skills. In this way, interventions utilising unemployed youth can create a sustainable long-term influence on unemployed youth and their communities.

Keywords: Early grade mathematics, EGM, EGM intervention, mathematics education, mathematics intervention, tutor programme, unemployed youth, South African rural schools, rural youth

Language editors' disclaimer

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I do hereby confirm that I have proof-read the dissertation entitled –
Evaluating a mathematics tutor programme for unemployed youth in a rural

context

By Mariana Annalien Strydom

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List of abbreviations

TIMSS   Trends in International Mathematics and Science Study

EGM   Early grade mathematics

CAPS   Curriculum and Assessment Policy Statement

MCC   Magic Classroom Collective

WMC-P   Wits Maths Connect Project

SANCP   South Africa Numeracy Chair Project

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Chapter 1: Introduction and background

1.1.   Introduction

The most vulnerable youth in the South African labour market are aged 15–24, with only one out of three young adults in this age group working (Statistics South Africa, 2021). Another predicament South African youth face is the poor mathematics achievement of South African learners in the Trends in International Mathematics and Science Study (TIMSS) in 2019 (Reddy, 2021). The question I asked was: *What are the potential capabilities of unemployed youth in South Africa that passed mathematics in Grade 12?* In this study, I conducted a qualitative evaluation of a tutor programme based on a mathematics intervention model utilising unemployed rural youth as tutors at a low-resourced rural school in Mpumalanga. The tutors had all passed Grade 12 mathematics and were trained and assisted to work with small groups of Grades 4 and 5 learners every week over three years. The primary goal of the intervention model, on which the tutor programme was based, was to improve learner performance in mathematics. The secondary goal was to give unemployed rural youth an opportunity to be developed and empowered as mathematics tutors by working directly with the learners. This study evaluated the tutor programme by seeking to understand its meaning from the points of view and experiences of the tutors as programme participants (Patton, 2015). The study investigated and described the participation experiences of these tutors in terms of the learning and teaching aspects of the model, as well as their personal journey from unemployment to tutoring. Not only did this investigation allow a streamlining of the existing model, it also created the possibility of informing other similar tutor-based interventions.

1.2.   Background

This study originated from a mathematics intervention model I designed, developed and implemented at a rural primary school in Mpumalanga. The mathematics intervention model is designed for rural South African primary schools and consists of three parts: mathematics content (A), tutors (B) and learner groups (C). The Venn diagram in *Figure 1.1* illustrates the conceptual design of the model. The tutor programme (Part B) is the focus of my study, and from this background, I will describe the conceptual design and implementation of the model on which the tutor programme is based.

Figure 1.1

Conceptual design of the mathematics intervention model
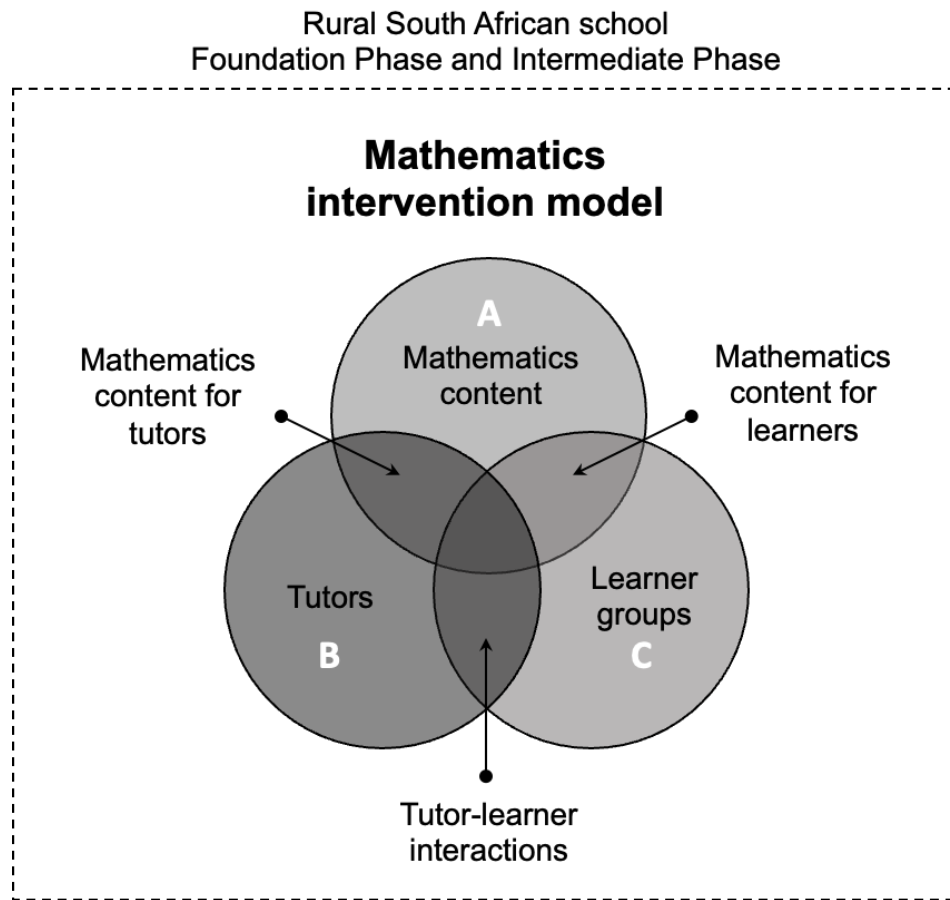
Part A represents the mathematics content for tutors and learners. For the learners, it is based on key mathematical concepts they need in the early grades for effective mathematics learning in future grades (Ukuqonda Institute, 2019). For the tutors, it is based on the mathematical content they need to tutor the learners. Part B represents the tutors that deliver the content and is designed for unemployed youth from rural (or similar) communities who passed mathematics in Grade 12. Part C represents the learner groups and applies to the early school grades, Grades R – 5, also referred to in this study as early grade mathematics (EGM). The use of the EGM construct in this study was motivated by the recent comprehensive studies reflecting on the EGM education system in South Africa, which included studies on Grades R - 5 in the South African schooling system (Venkat & Roberts, 2022b). Learner groups are organised based on learners' mathematical achievements and abilities and consist of six to seven learners per group. Intersection A with B represents the content I teach the tutors for

tutoring the learner groups. Intersection B with C represents the tutors' engagement with the learner groups when they are tutoring the learners. Intersection A with C represents the learners' experiences with the mathematical content during tutoring sessions. The centre of the model, where parts A, B and C intersect, represents the tutors' engagement with the learner groups with mathematics content when they are tutoring them. This describes the mathematics intervention model's conceptual design of the three parts (A, B and C) and four intersections, as illustrated in *Figure 1.1.*

I implemented the model for three years at a rural primary school in Mpumalanga for Grades 4 and 5 learners and am currently in my fourth year. I trained unemployed youth from rural communities who passed mathematics in Grade 12 as mathematics tutors to deliver mathematics intervention lessons to Grades 4 and 5 learners. Although the conceptual design of the model is for Grades R – 5, it has only been implemented for Grades 4 and 5 for the last three years at this school. The model focuses on learners' understanding of vital mathematical concepts in the early grades that will contribute to effective mathematics learning in future grades (Ukuqonda Institute, 2019). The learners in the rural school are exposed to large classes of more than 60 learners per class. Tutors are trained to deliver lessons to small groups of six to seven learners each, addressing learners' poor achievement levels and focusing on learners' individual academic needs. The model also focuses on developing the tutors' skills and preparing them for the workplace by providing experiences and activities that reflect real work experiences, such as time management, discipline, communication, teamwork and critical thinking. The model is therefore implemented to improve the mathematics achievement of rural learners while simultaneously developing unemployed youth from rural backgrounds.

The entirety of the study is based upon this mathematics intervention model, and I, therefore, decided to address the foundational aspects of the model in this section by discussing the rationale that underpinned the introduction of the model. The model originated from my ambition to design a solution that focused on improving mathematics education in rural schools while putting job creation at the heart of the solution. My experiences as a mathematics teacher convinced me to focus on the primary grades, laying the foundation for learners' mathematics performances in the higher grades. This is also supported in the literature (Ukuqonda Institute, 2019). The

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rationale for the tutor part of the model was underpinned by my experiences that private tutoring, addressing children's individual academic needs, is a desirable option for parents who can afford it and creates part-time jobs for young adults in affluent environments. This was further influenced by the adverse effect of large classes on the quality of rural education in South Africa, making it increasingly difficult for teachers to diagnose learners' individual problems (Du Plessis & Mestry, 2019). The rationale was that if unemployed youth in the community were trained as mathematics tutors, they could work with small learner groups to address learners' individual academic needs. It was further considered that this could potentially generate job opportunities for unemployed youth in the community, focusing on human development and improving the well-being and self-worth of the community. These considerations and experiences influenced the mathematics intervention model's conception. The model was presented to a potential funder, was accepted, and implemented at a rural school in Mpumalanga in 2020. Further detail on the model's background and historical timeline is discussed in Chapter 3 (Section 3.5.1) of this report as part of the context of this study.

1.3.   Rationale

The rationale for conducting this study stems from the results I recorded during the past three years as a result of implementing the mathematics intervention model. Evaluation is necessary for programmes to receive funding and to improve (Patton, 2015). Patton (2015) explains that although programme funders value the quantitative measurement of outcomes and statistics, they also need qualitative evaluations such as case studies, narratives, and participants' personal views to understand how a programme affects them. He points out that qualitative programme evaluation clarifies a programme's meaning in people's lives. I initiated this study to perform a qualitative evaluation of the tutor programme to determine how tutors' participation experiences can benefit the implementation of the current model and inform other similar tutor-based EGM interventions. I wanted to establish whether researchers and educators can benefit from the evaluation results and whether the study can contribute to educational research, mathematics education in rural schools (or other similar South African schools) and youth development. Researchers and educators involved in similar tutor-based EGM interventions can potentially benefit from this study.

The rationale is threefold. The first reason is the importance of mathematics as a school subject. According to Professor Loyiso Nongxa, ex-Vice Chancellor and Principal of Witwatersrand University, mathematics provides access to more than 70 percent of career opportunities (University of the Witwatersrand, 2017). Mathematics performance is vital for success in Science, Technology, Engineering and Mathematics-based careers (Sharpe & Marsh, 2022). These careers eventually fuel innovation and technological development to grow a country's economy (Human Sciences Research Council, 2021). However, looking at South African learners' achievement history in the TIMSS from 1995 to 2019, South Africa continues to achieve a low position on the ranking table of 64 participating countries worldwide participating in the TIMSS 2019 (Reddy, 2021). He recommends "strategically targeted interventions and additional effort from all education role players to accelerate the pace of improvement" (Reddy, 2021, p. 7).

The second reason for conducting this research is the potential influence of the study on rural education in South Africa. Rural South African schools face many challenges and are "marginalised and under-resourced" (Du Plessis & Mestry, 2019, p. S1). The rural environment in South Africa is considerably poorer in learning resources, and schools' needs are not being met (Hlalele, 2012). The challenges rural schools experience adversely affect the quality of rural education and hamper academic performance (Hlalele, 2012; Mohangi et al., 2016). Du Plessis and Mestry (2019) state that these challenges are mostly the result of poverty and unemployment. There is an evident relationship between poverty and South Africa's education standard (Nortje, 2017). Du Plessis (2014) believes that quality education is generally the only way to help rural learners trapped in the vicious spiral of poverty because it can enable further education, improve access to a career and contribute to overcoming poverty.

The third and last reason for conducting this inquiry is that the study's results can contribute to the skills development of unemployed youth in South Africa. South Africa's unemployment rate for the third quarter of 2021 was 34,1% (Statistics South Africa, 2021). The unemployment percentage for the youth is high at 59,5% of the total number of unemployed persons regardless of education level. Young adults have become disheartened from competing in the labour market (Statistics South Africa,

2021). They need to develop their skills because they are not working and are not in education or training (Statistics South Africa, 2021).

1.4. Problem Statement

In this study, a qualitative evaluation was conducted to determine whether a mathematics intervention model implemented at a low-resourced rural school in Mpumalanga could provide insight into rural mathematics education and how unemployed youth could be involved to become part of the solution to prevalent problems in mathematics education in rural (or similar) schools. This study's evaluation focused on the tutor programme based on this mathematics intervention model (*Figure 1.1,* part B, section 1.2). This evaluation sought to clarify the meaning of the tutor programme by understanding unemployed youths' participation experiences and how it affects their lives in tutoring Grades 4 and 5 learners as mathematics tutors in this tutor programme. Furthermore, it established how these experiences could be used to improve the current model and inform other similar tutor-based EGM interventions. It was vital to address the problem because rural schools, rural learners and unemployed youth are closely connected to the poor quality of education in rural schools (du Plessis & Mestry, 2019), the poor quality of mathematics education in South Africa (Reddy, 2021) and the high youth unemployment rate in the country (Statistics South Africa, 2021). The study provided potential solutions to developing the skills of unemployed youth while, at the same time, improving mathematics education. The benefits of solving the problem were that this study could have a sustainable long-term effect on the socio-economic status of future generations in rural, or other similar, communities.

1.5. Purpose Statement

The purpose of the study was twofold. Firstly, a qualitative evaluation has been conducted with a view to ascertain the meaning of the tutor programme by investigating and describing the experiences of unemployed youth tutoring mathematics to Grades 4 and 5 learners as part of the tutor programme in a mathematics intervention model (*Figure 1.1,* part B, section 1.2). Secondly, this evaluation has facilitated a what-works protocol, which could inform and benefit the

implementation of the model in its current location, as well as other similar tutor-based EGM interventions.

1.6. Research Questions

The following primary research question directed the study:

> *How can the experiences of unemployed youth, tutoring mathematics to Grades 4 and 5 learners as part of a tutor programme in a mathematics intervention model (Figure 1.1, part B, section 1.2) be used to refine the model and inform other similar tutor-based interventions?*

The following four secondary research questions will inform the primary research question. The secondary research questions address the different sections of the tutor part of the mathematics intervention model:

a) *How did the tutors experience the learning aspects in the intervention model regarding learning mathematics content enhancement, learning how to teach and learning the content to teach (intersection B with A)?*

b) *How did the tutors experience the teaching aspects in the intervention model regarding teaching small groups, teaching the lesson content and teaching with other tutors (intersection B with C)?*

c) *What were the tutors' personal experiences in the intervention model about job preparation, future career decisions, social and emotional well-being, adult development and socialisation (part B)?*

d) *How can the three aspects of the tutor programme, i.e., tutors' learning, teaching and personal development, be refined to improve the implementation of the mathematics intervention model and inform other similar tutor-based interventions?*

1.7. Conclusion

South African youth aged 15 – 24 are vulnerable. Two out of three are unemployed (Statistics South Africa, 2021) and the mathematics education they rely on to prepare them for their future careers is one of the worst in the world (Reddy, 2021). I decided

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to embark on a study to investigate the potential of unemployed youth who passed mathematics in Grade 12. This study originated from a mathematics intervention model I designed, developed and implemented at a low-resourced rural primary school in Mpumalanga. I evaluated the tutor programme based on the mathematics intervention model. In this tutor programme, I trained and assisted unemployed rural youth to work as mathematics tutors with small groups of Grades 4 and 5 learners to improve learners' performances in mathematics. The rationale for conducting this study stemmed from the results I recorded during three years of implementing the model. The rationale was threefold: the importance of mathematics as a subject (University of the Witwatersrand, 2017), the potential influence of the study on mathematics education in South Africa and the potential contribution to the skills development of unemployed youth in South Africa. The study aimed to investigate and describe the tutors' experiences in this programme. These experiences were identified as tutors' participation experiences in terms of the learning and teaching aspects of the model, as well as their personal journey from unemployment to tutoring. Then, the objective was to investigate whether the insights into these experiences can be of practical use and inform and benefit the implementation of the model in its current location and other similar tutor-based EGM interventions. The study provided potential solutions to developing the skills of unemployed youth while, at the same time, improving mathematics education in rural (or similar) schools in South Africa. The benefits of solving the problem were that this study could have a sustainable long-term effect on the socio-economic status of future generations in rural or other similar communities.

Chapter 2: Literature review and conceptual framework

2.1. Introduction

I started this chapter with a general review of the literature on the evaluation of educational programmes. Based on the programme I evaluated, I used the mathematics intervention model (as described in section 1.2) to guide me in selecting specific topics within the landscapes of mathematics education in South Africa, rural South African schools and youth development programmes. The mathematics intervention model helped me structure the literature review highlighting the specific features within these research landscapes relevant to this study. The following diagram illustrated in *Figure 2.1* shows how the mathematics intervention model guided my literature review.

Figure 2.1

Literature review topics and the mathematics intervention model
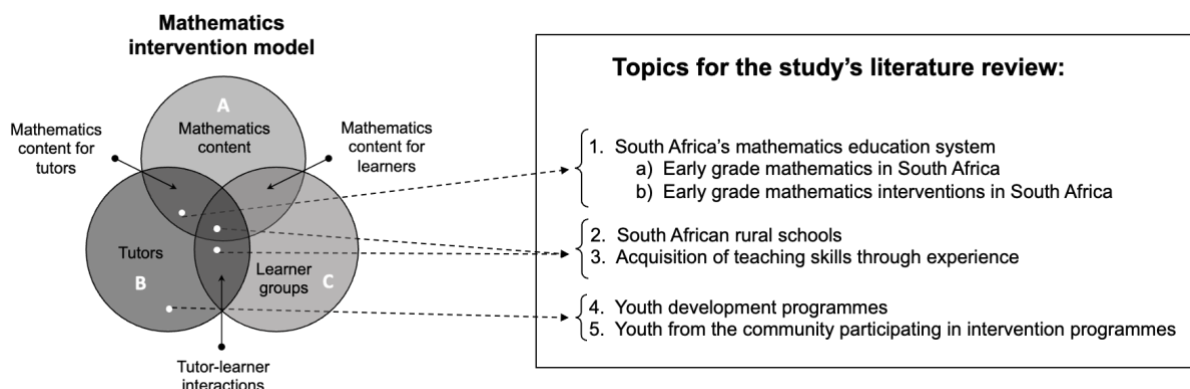
Intersection A with B represents the tutors learning the mathematics content for tutoring the learner groups. This guided me to review the literature on South Africa's mathematics education system, with EGM and EGM interventions in South Africa as subsections. I reviewed the literature on EGM and EGM interventions because the tutors learnt how to deliver interventions to Grades 4 and 5, categorised in the literature as part of EGM (Venkat & Roberts, 2022b). Intersection B with C represents the tutors' engagement with the learner groups (without the mathematics content), and the centre of the model, where parts A, B and C intersect, represents the tutors' engagement with the learner groups with mathematics content when they were tutoring them. These intersections guided me to review South African rural schools because all of these took

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place in a rural school. I then studied the acquisition of teaching skills through experience because tutors gained teaching experiences through practice. When teaching the lesson content, tutors followed the instructional approaches of the intervention design, and tutors described them as part of their experiences. I decided to include the instructional approaches of the intervention design in the context of my study in Chapter 3 because tutors' experiences were the focus of my study, not the intervention's mathematics content. Part B represents the tutors' participation experiences without mathematics content and learner groups. Although the primary goal of the intervention model was to improve learner performance in mathematics, the secondary goal was to allow unemployed rural youth to be developed. This guided me to review the literature on youth development programmes and programmes for youth participating in intervention programmes. As explained before, the tutor programme was the focus of my study, and the other parts of the model were outside this study's scope.

2.2. Evaluation of educational programmes

There are various definitions in the literature for the term evaluation. Stufflebeam (2003) looks at the root word in evaluation, value, and describes values as "any range of ideals held by a society, group or individual" (p.33). According to Stufflebeam (2003), a programme's services are evaluated against a set of criteria based on the values of the programme's stakeholders. Frye and Hemmer (2012) developed a guide on programme evaluation models and theories for the International Association for Health Professions Education (AMEE), representing 130 countries. They believe that people engage in educational programmes because they wish to change. They point out that although an educational programme's change is targeted at the learners, it affects everyone participating in the programme i.e., teachers, administrators, internal and external stakeholders. According to Frye and Hemmer (2012), it is evident that this principle should steer programme evaluation to focus on the changes related to a programme, both "intended and unintended changes" (p. 288). Cook (2010) gives twelve tips on evaluating educational programmes at the Mayo Clinic College of Medicine in Minnesota. Cook (2010) states that programme evaluation determines the programme's "merit or worth" (p. 296), and he explains that educators argue that "we want to know the value of the activity into which we have invested time, energy, and

other resources" (p. 296). Basaran et al. (2021) support Stufflebeam's belief that evaluation is critical in determining the extent to which a programme serves its intended purpose. They evaluated a preschool programme in Turkey. They explain that evaluating whether their programme accomplished its intended goals provided information about its success and improved functionality. Anh (2018) compares four well-known evaluation models for universities in Vietnam and shares this view when concluding that evaluation leads to improvement in the quality of educational programmes. My reason for evaluating the tutor programme resonated with the statement by Cook (2010) that programme evaluation determines the programme's value. Patton (2015) explains that qualitative evaluations such as case studies, stories, and participants' personal perspectives describe how a programme affects people's lives and clarify the meaning of a programme. By investigating and describing the tutors' experiences, I wanted to ascertain the tutor programme's value and meaning through the eyes of the tutors, determining whether it can inform similar tutor-based interventions.

2.3. South Africa's mathematics education system

Research into South Africa's mathematics education system has consistently pointed out that the system is in desperate straits (Jojo, 2020). It has become a cliche that most South African learners perform unsatisfactorily in mathematics (Taylor, 2021). This was also evident in South African learners' achievement history in the TIMSS from 1995 to 2019. South Africa continued to achieve a low position on the ranking table of 64 participating countries worldwide participating in TIMSS 2019 (Reddy, 2021). Taylor (2021) points out that although young adults pass mathematics in Grade 12, it does not mean they have mastered the concepts in the curriculum. South African learners are taught to pass mathematics at different levels but lack the understanding to connect mathematical concepts to real-life situations to improve their lives (Jojo, 2020). In addition to this, learners only need 30% to pass mathematics in Grade 12 due to the "political solution" (Jojo, 2020, p. 9) of lowering the quality of successful performance standards in mathematics in Grade 12. The TIMSS 2019 results for South African learners show that language proficiency and development levels continued to impact learner achievement (Reddy & Harvey, 2021). Another undeniable issue pointed out by the literature is the severe gaps in pre-service and in-service

mathematics teachers' subject knowledge; "mathematics teachers lack conceptual understanding of even primary school mathematics content" (Spaull et al., 2022, p. 29). Studies indicate low levels of content knowledge development during a four-year Bachelor's degree in Education (Bowie et al., 2022). I narrowed my review of South Africa's mathematics education system to EGM and EGM interventions in South Africa because of its relevance to my study.

2.3.1. Early grade mathematics in South Africa

The most recent comprehensive studies reflecting on the EGM education system in South Africa were published in three volumes involving Spaull and Pretorius (2022), Spaull and Taylor (2022a) and Venkat and Roberts (2022b). In the second volume, Venkat and Sapire (2022) reflect on research and policy in South Africa for EGM from 2000–2010. They found that during this period, there was limited reporting on the assessment and functionality of the curriculum implementation for the early grades, with the focus mainly on the higher grades. The limited research during this period mainly questioned teachers' understanding of mathematical progression, resulting in a slow advancement in learners' number sense development in the Foundation Phase (FP) grades. Venkat and Sapire (2022) describe this as follows:

> But there was also a growing accumulation of data from different types of studies that, collectively, was pointing to problems with mathematics as taught and learned in primary schools, and within this – specifically – showing that all was far from well in the teaching and learning of fundamental number concepts. (p. 8)

They believe 2000-2010 laid the foundations for a much wider focus on EGM research studies, development policies and projects that developed in 2010-2020. Although Venkat and Sapire (2022) report a "rich variation" (p. 12) in promising studies towards 2020, they describe vital issues that need to be addressed in EGM in South Africa, discussed in the following paragraphs.

An analysis performed by Spaull et al. (2022) of the Grade 5 mathematics outcomes in TIMSS 2015 and 2019 (this was the earliest primary grade with reliable data from TIMSS) also contributed to the concerns raised by Venkat and Sapire (2022). The analysis by Spaull et al. (2022) showed a "stagnation in learning outcomes in Grade 5 from 2015 to 2019" (p. 16), indicating that Grade 5 learners were at Grade 2 or 3 levels even before learning losses occurred during COVID-19. They demonstrated that class sizes were at an average of 36 to 46 learners per class in 2015 and increased to 50+ learners per class in 2019, with an uneven distribution of class sizes concentrated around 50+ and 60+ learners per class. They further established that this inflation in class size most likely caused the standstill of Grade 5 learners. They argue that this intensified teachers' inadequate content knowledge and pedagogical content knowledge. From the literature, they concluded that South African learners lack conceptual understanding and procedural fluency, even as they engage with basic mathematical concepts such as addition and subtraction of two- or three-digit whole numbers. Learners progress to higher grades despite not having a basic understanding of numbers, the base-ten system or the four operations (Spaull et al., 2022). Taylor (2021) supports this view, claiming that the scarcity of South African graduates in the mathematical and physical sciences is rooted in the country's primary schools. He states that high school learners pass the National Senior Certificate (NSC) mathematics examination by merely substituting numbers into formulae and argues that they will most likely fail at the tertiary level because they do not understand mathematical concepts. Similarly, Askew (2013) believes that one of the reasons for the low attainment in mathematics in South Africa is the absence of teaching ideas that are "mathematically and conceptually big" (p. 5) and contribute to the development of a deep understanding of mathematics in the early grades. The reality Spaull and Kotze (2015) points out is the burden on a country's economy when they argue that the later in life early learning deficits in mathematics are addressed, the more expensive the solution becomes. Venkat and Roberts (2022a) identify the following five priorities for improving outcomes in EGM learning by 2030:

1) mathematics-focused teacher-development programmes, 2) university-level capacity for mathematics-focused initial teacher education programmes, 3) school–university–government partnerships for research design hubs, 4) more

flexible working with the National Curriculum and Assessment Policy Statement (CAPS) and language policy, and 5) building capacity for school-based instructional leadership. (p. 208)

2.3.2. Early grade mathematics interventions in South Africa

I reviewed EGM interventions in South Africa to improve my understanding of how the mathematics intervention model I designed (on which the tutor programme is based) fits into the larger landscape of EGM interventions. I selected the following EGM intervention programmes for my literature review to inform my study: 1) the Magic Classroom Collective (MCC) (Porteus, 2022), 2) the Bala Wande (Sapire et al., 2022) and Funda Wande (Ardington & Henry, 2021) programmes, 3) the Witwatersrand Maths Connect project (WMC-P) (Venkat et al., 2022), 4) South African Numeracy Chair Project (SANCP) (Graven et al., 2022), 5) OLICO Mathematics Education (Bowie et al., 2022), and 5) the JumpStart programme (Moloi et al., 2022). In the next paragraphs, I briefly discuss each of these programmes.

Proteus (2022) reflects on the long journey of a mathematics intervention programmes from 2010 to 2017 in rural schools in the Eastern Cape, known as MCC, focusing on literacy and numeracy. The MCC intervention originated from the critical demand to improve education knowledge to inform policy and practice in mainstream schools in South Africa (Porteus, 2022). He explains that the programme provided teachers with instructional toolkits (especially learner workbooks and supporting tools), term-based teacher training and instructional coaching. This project also focused on home languages in teaching (Venkat & Sapire, 2022). The focus of the intervention was to give teachers direction to maximise the advantages of the available resources to change instructional approaches to improve mathematics teaching and learning in the context of teachers' classrooms (Porteus, 2022). The long-term goal is to develop "teacher autonomy" (Porteus, 2022, p. 117) by enabling teachers to make crucial classroom decisions when faced with difficult and constantly changing situations.

Bala Wanda programme (Calculating with Confidence) is a large intervention programme focusing on number sense development and an adjusted CAPS

curriculum (Venkat & Roberts, 2022a). This was achieved successfully by providing learner workbooks, teacher guides supported by videos, dictionaries and mathematical manipulatives (Venkat & Sapire, 2022). This programme applies the theory of moving from using manipulatives to doing mathematics by solving problems without concrete objects using representations and symbols (Mpofu et al., 2021). He further explains that mathematical games are an essential part of the Bala Wande intervention, and the programme pays particular attention to visual representations, such as diagrams, pictures and illustrations in familiar contexts to support independent learning. The aim is to develop the Bala Wande materials as an open educational resource (OER) to support FP teachers and students in improving mathematics learning (Mpofu et al., 2021). Sapire et al. (2022) present evidence that teachers use the Bala Wande materials and report small improvements in the early stages of implementation.

The WMC-P is an EGM intervention that started in ten historically disadvantaged public primary schools and developed at provincial and national levels from 2010 to 2020 (Venkat et al., 2022). Their baseline observations showed that they needed to improve early teaching and learning of numbers and primary teachers' mathematical and pedagogic content knowledge to support this. The project combined these two focus areas of knowledge and practice to implement the interventions for the whole CAPS curriculum (Venkat et al., 2022). They explain that these objectives were rolled out in various projects: training primary teachers in mathematical knowledge regarding teaching, the Structuring Number Starters (SNS) project working with FP teachers in schools and the Multiplicative Reasoning (MR) project using postgraduate student studies in classes. The WMC-P project also collaborated with the Rhodes Number Chair Project that emerged from this initiative. Venkat et al. (2022) conclude by saying that although a lot has been accomplished by the WMC-P, they recommend that the knowledge they gained should be applied to the Bachelor of Education pre-service mathematics teacher education programmes.

The SANCP at Rhodes University showed encouraging results by addressing early number-teaching in the classrooms and supplementing teachers' professional development with learner interventions (Graven et al., 2022). However, what differentiates this project from the other programmes discussed in this section (MCC,

Bala Wande and WMC-P) is their pioneering work to explore working with parents, carers and learners providing support and materials for after-school mathematics clubs (Graven et al., 2022). This work by the SANPC was taken further by a project known as OLICO Mathematics Education, which was motivated to scale up the after-school mathematics clubs by involving youth as educators (Bowie et al., 2022). The JumpStart Project programmes also recruit unemployed youth (Moloi et al., 2022). The interventions show promising results on a small scale consisting of teacher training once a year focusing on the pedagogy of teaching mathematics in the early grades (Moloi et al., 2022). In addition to teacher training, each school recruits and distributes teaching assistants, so there is at least one teaching assistant per grade. They are unemployed young adults and receive training for specific tasks from senior JumpStart professionals who provide regular on-site support. They receive stipends addressing their unemployment to a certain extent. The JumpStart programmes further consist of the NumberSense workbooks, and feedback via monitoring and evaluation, which is essential to the interventions (Moloi et al., 2022). The Funda Wande programme (Reading for Meaning) is part of the Bala Wande initiative and is based on the same approach (as described earlier). However, in Limpopo, the programme recruits unemployed youth as teacher assistants (Ardington & Henry, 2021). I again discuss the SANPC, OLICO Mathematics Education, JumpStart and Funda Wande projects in section 2.7 of the literature review with a specific interest in recruiting unemployed youth as community volunteers because of the relevance to my study.

Spaull and Taylor (2022b) look at a decade of early grade reading and mathematics interventions in South Africa from 2010-2020, and they conclude that:

> There is a need to invest in a new type of intervention. All interventions covered in this volume, and implemented over the last decade, are 'capacity' interventions aimed at either creating and distributing new materials (graded readers, workbooks, manipulatives) or providing additional support and training to teachers and government officials. (p. 20)

Spaull and Taylor (2022b) refer to recent research on teacher demographics, showing that 45% of all publicly employed teachers will retire within the next ten years. They believe this creates a unique opportunity to bring a new era of teachers on board and train and employ them to help alleviate one of the major underlying causes of South Africa's poor mathematics achievement history.

2.4. South African rural schools

South Africa has different rural areas determined by their social, economic, educational, and cultural aspects (Du Plessis, 2014). Mohangi et al. (2016) believe it is a flexible term which centres around the "socioeconomic, geographical and personal perspectives". Mohangi et al. (2016) defined the term "rural" as follows:

> Typically, rural areas are remote and relatively underdeveloped. As a result, many rural communities and their schools are poor and disadvantaged, lacking basic infrastructure for sanitation, water, roads and other transport, electricity and information and communication technologies (ICT). (p. 73)

The literature speaks of the following challenges in South African rural schools that negatively impact the quality of rural education and are hurdles to achieving academic success: the lack of teaching and learning resources (Mohangi et al., 2016; Porteus, 2022), the inadequate provision of well-qualified teachers (Du Plessis, 2017; Du Plessis & Mestry, 2019), lack of teacher support systems (Porteus, 2022), ineffective teacher development programs (Du Plessis, 2014), large classes or multi-grade classes (Du Plessis & Mestry, 2019), inadequate funding for school effectiveness and improvement (Du Plessis, 2017; Du Plessis & Mestry, 2019), lack of infrastructures such as sanitation, water, roads, electricity and information and communication technology (Du Plessis, 2020; Du Plessis & Mestry, 2019; Mohangi et al., 2016). It is evident that learners in rural schools are not only burdened by socio-economic hardships at home but also by considerable difficulties inside the classroom (Porteus, 2022).

The inadequate provision of well-qualified teachers at rural South African schools was relevant to my study and I gained insights into the literature on this issue. Du Plessis and Mestry (2019) found this as one of the main reasons for the poor quality of rural education in South Africa; rural schools do not appeal to qualified teachers due to insufficient financial funds. They believe the solution to a first-class education system is the sufficient supply of "appropriately trained, motivated, and engaged teachers in rural areas". They raise the concern that governments are more involved with developing teachers at urban schools while overlooking rural schools. Du Plessis (2017) goes so far as to say that "nobody much cares to talk about the challenges of educating poor rural learners" (p. 1). Du Plessis and Mestry (2019) recommend that attempts should be made to recruit candidates from rural backgrounds to teach in rural schools. They believe these individuals have the personalities or educational backgrounds to adapt and deal with rural living and teaching challenges in rural schools. They further argue that rural educators can only make informed decisions on what to teach their learners if they develop an appreciation of the circumstances they live in. This view is supported by Mohangi et al. (2016), raising the concern that there is limited focus on preparing teachers at rural schools to understand the diversity of the circumstances and environment they are placed in. Porteus (2022) points out that teachers in rural schools are not equipped and supported with adequate resources applicable to their classrooms' language and instructional contexts. Du Plessis and Mestry's (2019) believe that if the education system provides rural school learners with the skills they need for further education and future careers, it will lead to stable rural communities and contribute substantially to the country's ability to compete in the global market.

2.5. Acquisition of teaching skills through experience

Learning by doing or experiential learning is a theory of education (Kolb & Kolb, 2022). Although there are broad perspectives on experiential learning, Kolb and Kolb (2022) describe the everyday use of the term as a "form of learning from life experience, often contrasted with lecture and classroom learning" (p. 11). Zhang et al. (2011) evaluated a service-learning-tutoring project for teacher education at the University of Georgia. Zhang et al. (2011) define service learning as "the integration of community service into the academic curriculum" (p. 57). Through service learning, the goals of an

educational programme are achieved while servicing a community's needs (Zhang et al., 2011). Kolb and Kolb (2022) categorise service learning as one of the experiential learning practices. The evaluation by Zhang et al. (2011) revealed that exposing pre-service teachers to practice give them a better understanding of the teaching profession and the realities of teaching learners from diverse backgrounds. They claim these teachers are more likely to acquire essential instructional skills and stay in the teaching profession.

A study by Hinojosa and Bonner (2021) revealed similar results. They describe a programme that gives "underserved populations" in Australasia a means of entry to quality mathematics education. The program is a community project that links prospective teachers with parents from these communities through one-on-one online mathematics tutoring sessions. Parents receive free tutoring sessions to support their children at home (Hinojosa & Bonner, 2021). This program created practical experiences for prospective teachers with a "sense-making approach to learning mathematics" (Hinojosa & Bonner, 2021). Their study revealed that providing future teachers with practical experiences allows them to develop essential skills to advance as mathematics educators. The skills they emphasise are "sense-making, questioning, scaffolding, and discussion" (Hinojosa & Bonner, 2021).

Korthagen (2018) similarly believes the gap between theory and practice in teacher education is a growing concern in the Czech Republic and worldwide. Likewise, Van Putten et al. (2023) believe this is also the case in South Africa with the Bachelor's degree in Education that is generally very theoretical with a large gap between the practical work integrated learning (WIL) portion of the programme and the theoretical programme. However, Korthagen (2018) warns about the radical approach of 'practice first, theory later'. He warns educators against programmes where beginner teachers receive limited theoretical background, and teacher education becomes an induction process guiding the 'know-how' of teaching. He states that teacher shortages often influence this approach. He explains that if the balance shifts to relying on practical experiences, integrating theory into practice is eliminated, countering deep-rooted and long-lasting professional development and learning.

2.6.   Youth development programmes

Youth-specific interventions receive much attention in the literature because developing a country's youth is an important economic development factor (Fox & Kaul, 2018). Fox and Kaul (2018) discuss the design of youth development programmes for low-income countries as part of an effort by the World Bank to contribute to worldwide policy discussions. They emphasise that positive youth development leads to mature adults who can contribute to a country's economy (Fox & Kaul, 2018). Negative youth development has the opposite effect and can lead to detrimental behaviour such as teen pregnancy, crime, violence, poor health habits and withdrawal from society leading to poverty and reduced economic advancement (Fox & Kaul, 2018). There are various approaches in the literature for programmes targeted at youth, and these include: skills acquisition and employment outcomes (Kilimani, 2017), self-employment (Catalano et al., 2019; Fox & Kaul, 2018; Kilimani, 2017), building human capital (Johnstone & Schowengerdt, 2022; Kilimani, 2017), development of soft skills (Catalano et al., 2019), development of life or employability skills (Fox & Kaul, 2018; Johnstone & Schowengerdt, 2022), and social and emotional development (Barry et al., 2018).

Barry et al. (2018) believe there is increasing interest in international research on the effect of community-based programmes on young adults' social and emotional development. They reviewed programmes in the UK and found that although the evidence for the successful implementation of the interventions needs to improve, research shows that these programmes lead to positive health, educational, social and behavioural results. Kilimani (2017) states that although the most prominent interventions in developing economies are skills acquisition and microfinancing, "there is a gap in knowledge as to which skills are most profitable to acquire, and how and by whom they can be acquired" (p. 4). In contrast to this, Fox and Kaul (2018) point out that one of the major employment problems youth in low-income countries face is "job readiness" (p. 8) because they lack the life skills or employability skills to transition to the workplace. Johnstone and Schowengerdt (2022) investigate the limitations of only focusing on skills acquisition and employment opportunities for developing youth in Kenya. Johnstone and Schowengerdt (2022) also believe that the barriers youth face are the "skills-to-economic-opportunity" (p. 2) and that youth do not necessarily acquire these capabilities in skills programmes. Their study found that focusing

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beyond economic gain by concentrating on important aspects of youths' lives, such as interpersonal relationships, aspirations and social networks in the community, can convert youths' capabilities. Du Plessis and Ahmed (2020) conducted a study to explore the career aspirations of rural South African youth. They found that despite the youths' socio-economic circumstances, participants had positive career aspirations and were not discouraged by their rural backgrounds. However, they conclude that these young people need support, direction and discussions about their future desires. This aligns with the study's findings in Kenya (Johnstone & Schowengerdt, 2022), focusing on exploring youths' aspirations through relationships and social networks and developing skills to prepare them for the workplace.

2.7.   Youth from the community participating in intervention programmes

Suryani et al. (2022) explored the utilisation of Indonesian youth as "community educators" to educate their online peers and digital community through their own digital works. The program utilised the youth as active educators, programme architects, forerunners of change and executors rather than inactive recipients of youth programmes (Suryani et al., 2022). They believe that focusing on the youth to participate in community development at these crucial ages prevents them from future negative behaviour and converts them into valuable resources and productive adults. Another study in Indonesia by Suryani and Soedarso (2021) explored transforming a rural village into a "smart village" (p. 39) by using the local people as human assets for development. They focused on the effect of participation on the sustainability and longevity of the development. Suryani and Soedarso (2021) argued that rural development may not be sustainable if the people in the community do not endorse it because they are the community's "quality human resources" and "human assets for development" (p. 39). The people in the community are the "agents of change" (Suryani & Soedarso, 2021, p. 39), the catalysts of transformation and the real role players in improvement. Suryani and Soedarso (2021) also found that this improvement motivates the youth to stay in the community instead of going to the city to earn more money. If there is no participation or engagement in their own community, the "development agents" (Suryani & Soedarso, 2021, p. 45) leave the community. For this reason, they believe it is essential to strengthen their capabilities to improve the community's longer-term social and economic well-being.

In South Africa, Du Plessis and Mestry (2019) explore the perceptions and experiences of rural teachers in Mpumalanga, South Africa. They have a similar view to their Indonesian peers and recommend the involvement and participation of the community for the successful implementation of policies or programmes in rural societies. They recommend that the South African government involve communities in teaching and improving schools. Graven et al. (2022) report on primary mathematics interventions that took place after school in the form of mathematics clubs and family mathematics story-time programmes involving parents, carers and learners as part of the SANCP at Rhodes University. Graven et al. (2022) claim to have seen the benefits of "embedding" (p. 167) these programmes into the community through schools, community organisations and parents. Their work shows an improvement in learners' performances and mindsets towards mathematics. Their constructive way of involving the community's people to engage in mathematics through "Family Maths Days" led Graven et al. (2022, p. 167) to believe that it is essential to establish close relationships with the community's people as part of this intervention programme.

Bowie et al. (2022) discuss how the OLICO Mathematics Education programme built on the work of SANCP. They explored ways to scale-up the OLICO programme when they recognised high school learners' entry to mathematics was restricted by poor number sense. This motivated them to work with primary school learners in after-school mathematics clubs. Their demand for facilitators to maintain a low learner-facilitator ratio led them to consider training unemployed youth. They based this on researched evidence in India, successfully using community volunteers to address learning gaps in language and mathematics (Banerjee et al., 2016). They also based it on interventions in Ghana using youth employment schemes to employ teaching assistants to improve student learning in mathematics and English (Duflo et al., 2022). The project in India trained community volunteers for interventions in the classroom for one hour per day, delivering positive outcomes. They also trained them for interventions outside of school, but the results were less promising because the utilisation was low (Banerjee et al., 2016). In Ghana, the interventions were government programmes hiring youth from the local community as teaching assistants either in after-school remedial lessons or in class for part of the school day, both leading to positive results (Duflo et al., 2022). Bowie et al. (2022) explain that using

unemployed youth in the OLICO programme is still in the early stages, and it requires comprehensive, structured and detailed material design parallel to well-planned facilitator training; but they believe there is potential. They are also considering face-to-face training supported by video and cellphone applications.

In South Africa, the JumpStart programme also trains unemployed youth to use the NumberSense workbooks and receive training for specific tasks from senior JumpStart professionals who have provided regular on-site guidance to support mathematics learning since 2016 (Bowie et al., 2022). They receive stipends addressing their unemployment (only to a certain extent). The Funda Wande project in Limpopo also appoints and trains unemployed youth as teaching assistants to work with teachers in classrooms on reading and numeracy (Bowie et al., 2022). This socio-economic approach is rising in South Africa (Oluwajodu et al., 2015) and Ardington and Henry (2021) believe utilising the capabilities of unemployed youth in South Africa has potential. This addresses the issues of large classes (Spaull et al., 2022) and the high unemployment youth rate (Statistics South Africa, 2021). In 2020, the Presidential Youth Employment Initiative (PYEI) and Basic Education Employment Initiative (BEEI) placed nearly 320 000 youths across 27 600 public schools as education and general education assistants for five months (Department of Basic Education, 2021). However, there has been no programme evaluation of the impact of this initiative so far (Ardington, 2023).

2.8. Conceptual framework

I selected social constructivism as the approach in my study because the tutors' experiences, as described by Akpan et al. (2020), were constructed through social interaction, the help of others and in groups under my guidance, as their facilitator. My thinking was further supported by Ernest's (1991) explanation that mathematics is socially constructed when viewed through the lens of social constructivism. He explains that mathematical knowledge is influenced by linguistic knowledge, which is constructed through social interaction. In other words, the tutors' mathematical knowledge was influenced by their linguistic knowledge and was socially constructed when they learnt the mathematical content during group training sessions and when teaching the content to the learners in small groups. Ernest (1991) further elaborates

that social constructivism acknowledges the construction of both subjective and objective knowledge "in a cycle which each contributes to the renewal of the other" (p. 43). When applied to the tutors, it meant that while they learnt mathematics, the tutors' personalised objective knowledge and reconstructed it to become subjective knowledge. Ernest's (1991) views on mathematics as a social construction helped me to understand how the tutors' mathematical experiences were constructed.

My choice of applying social constructivism as the approach in my study assisted me in developing a more focused conceptual framework that I could apply in dealing with the key variables of interest being studied. As explained by Nieuwenhuys (2020), it helped me to arrange my study's data into logical "bins" (p. 82) to organise, analyse and interpret the data. I had to identify the tutors' experiences I wanted to collect, analyse and understand to evaluate the tutor programme. I decided to draw these experiences from the mathematics intervention model (described in section 1.2), on which the programme was based. Although tutors' experiences were not exact and could not be restricted to specific parts and intersections of the model, the model served as a map to identify the key experiences that formed the main constructs of the conceptual framework. The key experiences I drew from the model were the tutors' experiences regarding the learning and teaching aspects of the mathematics intervention model and their personal experiences. This is illustrated in *Figure 2.2.* Intersection B with A reflects tutors' experiences learning the mathematical content. Intersection B with C reflects their experiences teaching the mathematical content to the learner groups, and the model's centre (where A, B and C intersect) reflects tutors' learning and teaching experiences with mathematical content and learner groups. The rest of part B without the intersections, reflects tutors' personal experiences without mathematics content or learner groups. I then narrowed it down further by defining sub-constructs within each main construct. I used the results I recorded during the three years of implementing the model (discussed in my data collection strategies in section 3.5.3) to identify the sub-constructs I wanted to study within each main construct. The diagram, illustrated in *Figure 2.2*, shows how the tutors' experiences defining the main constructs and sub-constructs of the conceptual framework relate to the different intersections of the mathematics intervention model.

Figure 2.2

Tutors' experiences and the mathematics intervention model
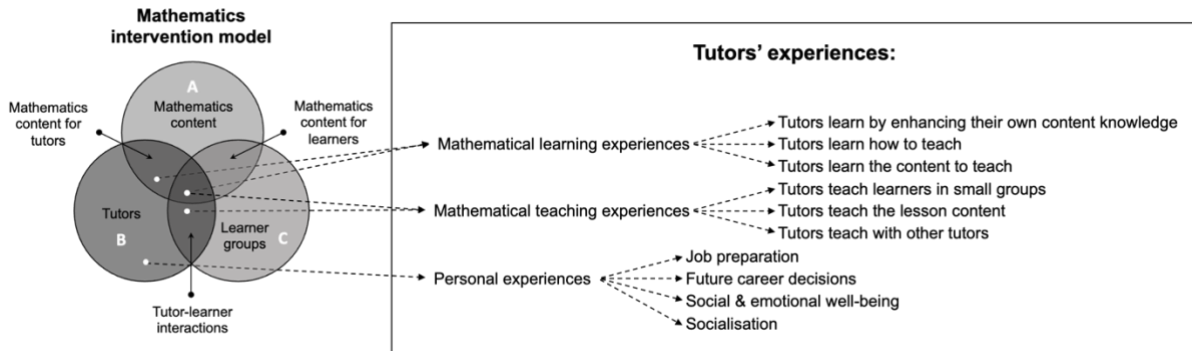
Based on this, I developed the conceptual framework illustrated in *Figure 2.3.* My conceptual framework is a logical structure specifying and defining the experiences I wanted to investigate and focus on during my study. It shows how I saw these experiences linked to each other.

Figure 2.3

The conceptual framework for tutors' participation experiences

As indicated in *Figure 2.3*, the conceptual framework consisted of eleven sub-constructs. I developed the conceptual framework to answer all four sub-research questions and, in this way, answered the main research question. My analysis of the findings for sub-constructs 1-11 provided me with answers to the first three sub-research questions. I worked through the findings for all 11 sub-constructs and answered sub-question 4. In this way, I answered the main research question. This is illustrated in *Figure 4.1* in Chapter 4, where I organised, analysed and interpreted the tutors' experiences at the hand of these eleven sub-constructs and discussed how the findings for each sub-construct answered the sub-research questions.

2.9.   Conclusion

This chapter reviewed the literature, selecting topics within the landscapes of mathematics education in South Africa, rural South African schools and youth development programmes. The mathematics intervention model, on which the programme was based, guided the selection of topics for the literature review

highlighting the specific features within these research landscapes relevant to this study (illustrated in *Figure 2.1*). After discussing the literature, I explained why I selected social constructivism as the approach to my study and how it allowed me to develop my study's conceptual framework. Again, I discussed why and how I decided to use the mathematics intervention model as a map to develop the study's conceptual framework (illustrated in *Figure 2.2*). The conceptual framework consisted of 11 sub-constructs (illustrated in *Figure 2.3*) that I used to organise, analyse and interpret my data. I developed the conceptual framework with my sub-research questions in mind, ensuring that the data I collected from the 11 sub-constructs answered my four sub-research questions. In answering the sub-research questions, I answered the study's main research question.

Chapter 3: Research design and methodology

3.1. Introduction

This chapter describes the study's research design and epistemology. During this study, I evaluated a tutor programme as part of a mathematics intervention model (part B, *Figure 1.1*, section 1.2) by investigating unemployed youths' experiences as tutors at a rural school in Mpumalanga for Grades 4 and 5 learners. As discussed in Chapter 2, I selected social constructivism as the approach in my study to guide the evaluation. Therefore, the study's ontology, epistemology, methodological paradigm and research design were based on social constructivism principles and concepts and are discussed in sections 3.2, 3.3 and 3.4. The conceptual framework I developed for this study in section 2.8 was also based on social constructivism and dictated the study's methodology, discussed in section 3.5. Lastly, this chapter addresses the study's methodological norms in section 3.6 and ethical considerations in section 3.7.

3.2. Epistemological paradigm

The study aimed to investigate, understand and describe tutors' participation experiences in a mathematics intervention model in a complex social structure. This study was based on a social constructivist ontology which, as Tuli (2011) explained, accepted participants' (in this case, the tutors) subjective construction of reality through social processes. Ernest (1991) proposes social constructivism as a philosophy of mathematics describing the construction of mathematical knowledge as a social process. He grounds this on the key role language and interpersonal social processes play in interpreting, formulating and verifying mathematical truths, implicating that objectivity is also social. This means that the tutors constructed their truths of mathematics in the tutor programme based on the social processes they were involved in, determined by their linguistic knowledge and their construction of objective knowledge, which is also social. Tuli (2011) explains that if participants' views and experiences are socially constructed and complicated, they are not exact and cannot be measured. Therefore, the study's reality was a subjective construction of reality because the tutors expressed their thoughts, ideas and opinions and I deducted meaning from this.

The epistemology of the study was based on a social constructivist ontology, which is a relative ontology. This means that participants' experiences are subjectively observed and cannot be quantified (Levers, 2013). In other words, the tutors' participation experiences were personal, based on inner experience rather than facts, and could not be measured. Levers (2013) describes subjective epistemology: "Observations are influenced by the observer, and the observer is influenced by the observed." (p. 3). The interpretivist paradigm applied to the study's relative ontology and subjectivist epistemology (Nieuwenhuis, 2020). I derived meaning from human experiences, and my interpretation and beliefs influenced the results. The tutors' realities were determined by their participation experiences and how they viewed and interpreted these experiences. I deducted meaning from these opinions and ideas, and my interpretation and beliefs influenced the results.

3.3. Methodological paradigm

This study accounted for tutors' social realities, and as Maree (2020) explains, a qualitative methodology is the most appropriate design to answer research questions that focus on social settings where interactions occur. I investigated tutors' participation experiences by asking exploratory questions to collect data to answer the research questions. As Maree (2020) describes it, I relied on words (language) and facial expressions to understand concepts, opinions or experiences, and gather in-depth insights into how the tutors organised themselves in a situation and made sense of themselves in their environment. This study's environment consisted of the tutor programme based on the mathematics intervention model at the rural school in Mpumalanga. I gained insights into the tutors' experiences (their social realities) in this environment. These insights lead to further investigation, exploring how it could be used to refine the current model and inform other similar tutor-based interventions.

3.4. Research design

3.4.1. Case-study approach

The case study approach to qualitative analysis refers to the specific method of collecting, organising and analysing the study's data, representing the data analysis process of the research (Patton, 2015). The result of this analysis process is a case study. I selected a case study approach as the most appropriate type of inquiry to

guide the research design for this study. The mathematics intervention model is a complex phenomenon in a real-life situation. It has a complex structure, with participation experiences occurring in all the different parts and intersections of the intervention model (*Figure 1.1*, section 1.2). I agreed with Yin (2018) that the choice of case-study research design allowed me to explore and analyse the tutors' experiences within this complex real-world structure. Yin (2018) explains that a study is relevant as a field experiment if the research questions investigate "how" and "why" the programme had worked (or not), and this applied to my study. Yin (2018) further explains that case study research has a rightful place in evaluations and is applicable when describing "an intervention and the real-world context in which it occurred" (p. 49). The nature of a case-study design allowed a comprehensive approach to collecting detailed knowledge about the tutors' experiences providing an "in-depth understanding of the case" (Creswell, 2013, p. 98). The case had boundaries defined by place and time (Creswell, 2013), limiting the study's evaluation to the tutor programme in the mathematics intervention model (part B, *Figure 1.1*, section 1.2) that took place from 2020 to 2023 at the rural school in Mpumalanga where the model was implemented. Maree (2020) drew my attention to the importance of a close collaboration between myself (the researcher) and the tutors (as participants), allowing them to share their views. I worked closely with the tutors for three years, setting the platform for them to exchange their viewpoints. Apart from working closely with the participants, I am the intervention model's designer, developer and implementer. Maree (2020) explains that the case-study design does not completely reject the idea of objectivity. Still, as explained by Cousin (2005), it acknowledges my influence, is based on the constructivist paradigm and "tends to be researcher-centred" (Maree, 2020, p. 90). The case-study design, therefore, recognises my intricate involvement in the process.

3.4.2. Type of case study

The type of case study for this research was an *intrinsic case study*. Researchers conduct intrinsic case studies to improve their understanding of a case that attracts their interest because of a particular aspect (Cousin, 2005; Creswell, 2013; Maree, 2020). Intrinsic case studies are often used for evaluation research (Cousin, 2005; Creswell, 2013). I initiated this research to improve my understanding of the tutor

programme of the mathematics intervention model. Using evaluation research, I could "assign worth to a particular set of activities and experiences" (Cousin, 2005, p. 422). In other words, evaluating my tutor programme improved my understanding of the value of the mathematics intervention model. This knowledge helped me to understand how it could inform similar tutor-based interventions and contribute to the quality of rural mathematics education and the development of unemployed youth in South Africa.

3.4.3. Layered case study design

I decided to use a "layered case study design" as described by Patton (2015, p. 1063). I evaluated the tutor programme as a single case study by doing several case studies of the tutors as participants within the single program case (Patton, 2015). This layered case study approach is shown in *Figure 3.1*.

Figure 3.1

Layered case-study approach (Patton, 2015)
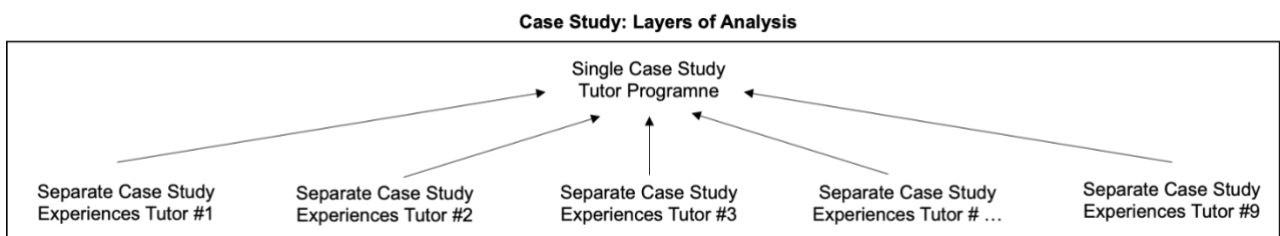
This approach applied to my study because it allowed me to "combine studies of individuals into studies of a program" (Patton, 2015, p. 1064). The layered design guided my analysis process to start at the lowest level and gain a thorough understanding of the complexities of the individual cases to ultimately understand, investigate and describe the programme as a single case (Patton, 2015).

3.5. Research Methodology

3.5.1. Site selection and context

a) School

The school where the study was conducted was selected because the mathematics intervention model (described in section 1.2) had been implemented at this school

since 2020. The model was implemented at a rural public school approximately 20 km outside Middelburg in Mpumalanga. A coal mining company in Mpumalanga funded the design and implementation of the model as part of the mine's Social Labour Plan (SLP) to fulfil their legal commitments. The mine selected this school because it is in the community where the mine was established.

I will first describe the school (the context) in this paragraph from a factual point of view, and I will then give my personal interpretation of the school based on my involvement, in the next paragraph. It is a Quintile 1 school based on the national poverty ranking of South African public schools and learners (quintiles). Quintile 1 is the poorest, and Quintile 5 is the least poor (Department of Basic Education, 2017). The poverty score assigned to a school is based on the poverty of the surrounding community (Department of Basic Education, 2017). The three indicators of poverty are households' income levels, the community's unemployment rate and the levels of education (Department of Basic Education, 2017). The school is situated in a remote and rural area approximately 20 km outside Middelburg and is surrounded by farms and rural villages. It is approximately a 20-minute walk from one of the villages. Learners from this village walk to the school, and the rest are transported by bus from the farms and other villages. It is a combined school, which means it is a primary and secondary school with approximately 900 learners in both schools in 2023. One principal manages both schools. The primary school consists of approximately 400 learners from Grades R – 6 with eight teachers, and the secondary school has approximately 500 learners from Grades 7 – 12 with ten teachers. In the primary school where I am involved, there are buildings to accommodate one grade per classroom, and each grade's classes vary between 50 – 70 learners in one classroom. The primary school's buildings and classroom facilities (desks, chairs, etcetera) are all maintained in reasonable working condition. There are cleaning staff, daily keeping the school grounds and buildings neat and clean. There is electricity, running water and functional ablution facilities.

I have worked closely with this school's principal and mathematics teacher since 2020. My view is that although it is a typical South African rural school experiencing the familiar challenges rural schools in South Africa face (Du Plessis & Mestry, 2019), it is a well-managed rural school because of the principal's focus and leadership. He takes

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the initiative to approach businesses in the area to obtain funding for additional things needed to improve his school's education quality. In my opinion, this filters down to his teachers; they have a positive working culture and are a dedicated team of teachers. The principal also identified and selected tutors from the communities to participate in my tutor programme. Since 2020, 18 young adults have participated in the program, and everyone he recommended was suitable and dedicated to making it a success.

b)   Historical timeline of the mathematics intervention model

My reason for including the historical timeline as part of the context was to put the events of implementing the mathematics intervention model in chronological order explaining the full picture from beginning to end so the reader could understand the model's growth. In September 2019, I submitted a proposal to a coal mining company in Mpumalanga to implement the mathematics intervention model. The mine's management approved the proposal in February 2020, and I initiated the relevant engagement and consultation with the school principal, the Grade 4 mathematics teacher and the community. The implementation of the mathematics intervention model started on 1 March 2020 with seven tutors and 55 Grade 4 learners; tutors delivered the intervention lessons to small groups of 6-8 learners each. In March 2020, schools closed for the COVID-19 pandemic, and in April 2020, only the tutor programme resumed online using WhatsApp and Zoom. Online assignments were submitted, and educative feedback was given to maintain interest and ensure continuous involvement and development of tutoring capability. After six months of school closure during the pandemic, the implementation of the mathematics model resumed in September 2020 until the end of 2020. At the beginning of 2021, the school principal and the mine's management decided that because learners did not attend school for six months in 2020, interventions would focus on the same group of learners in Grade 5 in 2021. At the beginning of 2022, the school principal and the mine's management decided to continue with the mathematics intervention model for the Grade 4 group in 2022. In 2023, the model implementation continued at this school with 11 tutors and 68 Grade 5 learners.

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c) Mathematics content and instructional approaches of the interventions

This section briefly describes the intervention model's mathematics content and the lessons' instructional approaches. I decided to include these in the context because tutors referred to the mathematics content and instructional approaches they learnt when they described their learning and teaching experiences. The intervention design is based on developing learners' conceptual understanding and procedural fluency of the fundamentals of mathematics in the primary years (Askew, 2013; Haylock, 1991; Spaull et al., 2022; Sullivan, 2011). It concentrated on number sense development, the base-ten system and the four operations (addition, subtraction, multiplication and division). Topics such as fractions that rely on these competencies were only dealt with once learners had mastered the fundamentals.

The lessons were based on the following well-researched instructional practices: small group learning (McKimm & Morris, 2009; Merrit, 2016; Springer et al., 1999), differentiated instruction based on learners' academic needs (Du Plessis, 2020; Sullivan, 2011), using manipulatives to represent the same concept differently (Larbi & Mavis, 2016; Mpofu et al., 2021; Sarama & Clements, 2016), explaining mathematical concepts through meaningful and familiar real-life situations (Gravemeijer & Cobb, 2001; Haylock, 1991) and incorporating small group games in the learning of mathematics (Graven et al., 2022; Haylock, 1991). The definition for manipulatives used in this intervention model is learning materials "that learners can use to learn or form mathematical concepts. In other words, any material or object that helps learners understand mathematics. Such materials help to reduce the abstract nature of mathematics as perceived by many students." (Larbi & Mavis, 2016, p. 55). The materials used by the tutors in their lessons are one or more of the following materials: counters, plastic cups, place value cards, base ten blocks, photos, drawings and other realistic objects relevant to the lesson content. Interventions took place in a multilingual context and tutors and learners used both main languages, isiNdebele and isiZulu plus English. Using multiple languages promotes learners' vocabulary development and understanding of mathematics (García & Wei, 2014).

d)   Tutor training

I decided to describe the tutors' training as part of the context of the study because the experiences that I studied occurred in these activities. Tutors' training consisted of face-to-face structured group training sessions before and after learner intervention sessions and online assignments during school holidays. Learner intervention sessions took place twice a week during school hours (as opposed to after school) because all the learners were transported by bus to distant locations when the school closed. Tutors received their lessons on the tutor WhatsApp group the day before learner interventions, and they were responsible for coming to school the next day prepared to deliver their lessons. All the tutors did not always give the same lessons. The programme's content consisted of a series of lessons on a specific topic. For example, if there were 20 lessons on multiplication, tutors progressed through the lessons at their own pace, depending on their group's progress. Tutors arrived at school two hours before learner interventions started, and then I trained them to deliver the lessons to the learners. I facilitated the training through group discussions or tutors presenting their lessons to the rest of the group. Thereafter, tutor-learner sessions took place, and I monitored tutors. The mathematics teacher occasionally observed these sessions. After tutor-learner sessions, all the tutors gave feedback on their lessons, discussing their successes, challenges and progress. Again, I facilitated these reflective feedback sessions through group discussions. After this, tutors received mathematical problems to solve in small groups to develop their mathematical subject knowledge (tutors referred to these as the "jellybean challenges" because the winners always received jellybeans). During school holidays, tutor training took place through online assignments tutors submitted on the tutor Whatsapp group focusing on the continuous development of tutoring capability and subject knowledge.

e)   Programme administrator

Since implementing the mathematics intervention model, I employed an administrator for the tutor programme from Mpumalanga. Like most tutors, her home language was isiNdebele, and she could also speak isiZulu. I decided to describe this role as part of the context of my study because it was an essential function that served as a vital interface between the tutors and myself. She performed many routine tasks such as administering attendance registers, preparing tutors' weekly lesson packs with

learners' books and relevant learning materials for lessons, covering the workbooks, checking that tutors marked their learners' workbooks, managing the stationery and many more. However, the essence of her role lay in the value she added when she assisted me in understanding the tutors' language, culture and social behaviour. There were many different cultural and social elements I had to take in and fully process. She was familiar with the complexities and intricacies of the local culture, and she picked up social cues and understood the verbal and non-verbal communication in the group. She helped me to have an open mind when confronted with cultural practices that were difficult to comprehend, allowing me to absorb what was going on and how it was significant to the tutors' cultural beliefs and customs. I believe all of these helped me make informed decisions in dealing with social and cultural aspects and were vital to the efficient operation of the tutor programme.

3.5.2. Sampling

The two target populations for this study were 1) rural South African schools and 2) unemployed rural youth in South Africa. The study populations were rural primary schools in South Africa and unemployed youth who passed mathematics in Grade 12. The samples chosen for both populations were purposively selected with specific objectives in mind. The rural primary school sample was chosen because the mathematics intervention model was implemented in this school. The sample of nine young unemployed adults selected to participate in the study were nine tutors participating in the intervention model during 2020, 2021, 2022 and 2023. The target populations, study populations and sample groups for this study are illustrated in *Figure 3.2*.

Figure 3.2

Target populations, study populations and sample groups of the study
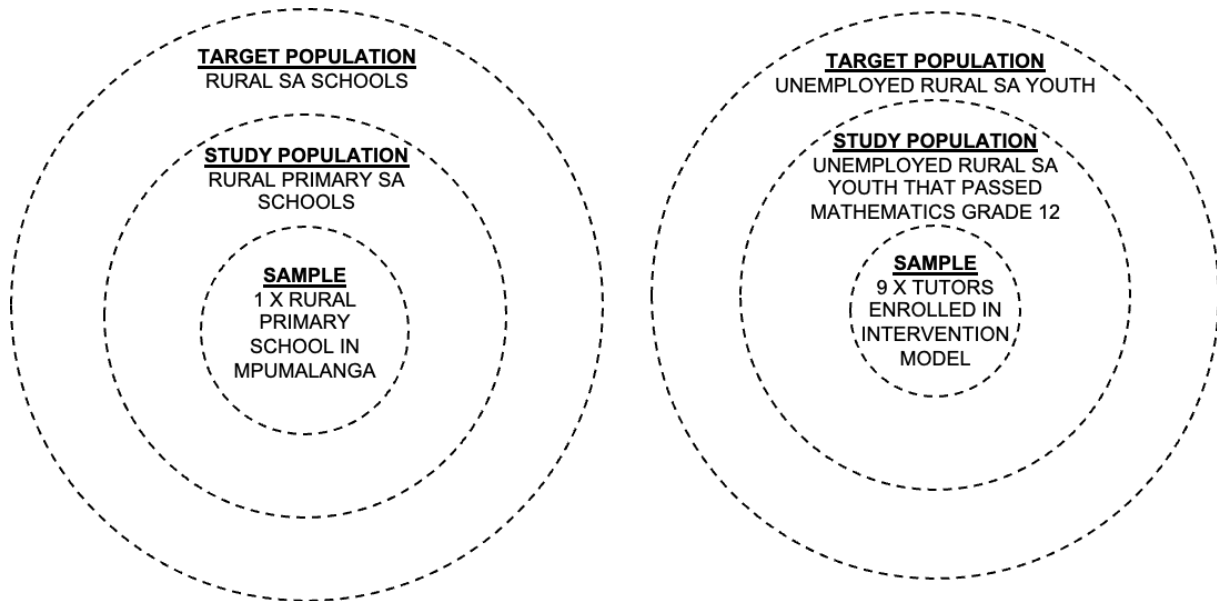
The sample consisted of six female tutors and three male tutors between the ages of 19 and 30. The following participation criteria applied to the tutor programme: 1) tutors must live on the farms or rural communities surrounding the school, 2) tutors must have passed mathematics Grade 12, and 3) the school principal must have recommended and approved their participation. In the next paragraphs, I introduced each participant individually through "introductory narratives" (Barnes, 2009, p. 71). I wrote these narratives based on the information the tutors made available to me during the tutor programme's training sessions in either individual or group discussions, both formal and informal. I did not add my interpretation to the narratives. I decided to give the tutors pseudonyms (fictitious names) that are more personal because it is a qualitative research study (Barnes, 2009).

Sihle

Sihle joined the tutor programme in June 2021. She was 26 in 2023, matriculated in 2015, and passed mathematics with 58%, and her home language is isiNdebele. She has a seven-year-old son in Grade 2 in the same school where the tutor programme is implemented. She and her son lived with her parents in the local village. Her father had a local taxi business; she sometimes drove the taxis if there were no drivers, and her father needed her help. Other than that, she was unemployed and not studying or

working part-time. She participated in the tutor programme for which she received a stipend. She used her stipend to support her family financially and did not receive money from her parents during the months when she did not receive a stipend.

Towani

Towani joined the tutor programme in February 2022. He was 20 in 2023, matriculated in 2021, and passed Grade 12 mathematics with 39%, and his home language is isiNdebele. He stayed in Middelburg with his four brothers. He was unemployed and studied for a Higher Certificate in Education at UNISA in 2023 with a National Student Financial Aid Scheme (NSFAS) bursary. He participated in the tutor programme for which he received a stipend. He used his stipend to support his family financially and did not receive money from his parents during the months when he did not receive a stipend.

Pemma

Pemma joined the tutor programme in March 2020. She was 23 in 2023, matriculated in 2018, and passed Grade 12 mathematics with 42%, and her home language is isiSepedi. She stayed with her husband in Middelburg and had a one-year-old baby daughter (in 2023). At the end of 2021, she applied to study for a Higher Certificate in Education at UNISA but was not admitted, and instead studied for a certificate in Human Resources Management at Nkangala TVET College in 2022. In 2023, she was unemployed and not studying or working part-time. She participated in the tutor programme for which she received a stipend. She used her stipend to support her family financially and received money from her husband during the months when she did not receive a stipend.

Phuti

Phuti joined the tutor programme in March 2020. He was 23 in 2023, matriculated in 2018, and passed Grade 12 mathematics with 40%, and his home language is isiNdebele. He stayed with his mother in the local village. He was unemployed and not studying or working part-time. He participated in the tutor programme for which he received a stipend. He used his stipend to support his family financially and did not receive money from his mother during the months when he did not receive a stipend.

Ziyani

Ziyani joined the tutor programme in March 2020. He was 22 in 2023, matriculated in 2019, and passed Grade 12 mathematics with 44%, and his home language is isiZulu. He stayed with both his parents in the local village. He was unemployed and not studying or working part-time. He participated in the tutor programme for which he received a stipend. He used his stipend to support his family financially and did not receive money from his parents during the months when he did not receive a stipend.

Jabula

Jabula joined the tutor programme in August 2020. She was 25, matriculated in 2016, and passed Grade 12 mathematics with 58%, and her home language is isiZulu. She stayed with her mother and siblings in the local village. She was not studying and worked part-time for her sister, an event organiser for birthday parties in Middelburg. She planned to study teaching. She participated in the tutor programme for which she received a stipend. She used her stipend to support her family financially and did not receive money from her mother during the months when she did not receive a stipend.

Mnguni

Mnguni joined the tutor programme in March 2020. She is 23, matriculated in 2018, and passed Grade 12 mathematics with 30%, and her home language is isiNdebele. She stayed with her sister and two brothers in the local village. She was unemployed and not studying or working part-time. She participated in the tutor programme for which she received a stipend. She used her stipend to support her family financially and did not receive money from anyone during the months when she did not receive a stipend.

Sally

Sally joined the tutor programme in June 2022. Her home language is isiSepedi and she stayed on a farm in the area with her parents and siblings. She is 30, matriculated in 2011, and passed Grade 12 mathematics with 46%. After matric, she completed her N6 electrical qualification, after which she worked at a dolomite mining company in Pretoria for 5 years. She then resigned and studied full-time for a Chemical Engineering diploma at UNISA with an NSFAS bursary. She participated in the tutor programme for which she received a stipend. She used her stipend to support her

family financially and did not receive money from her parents during the months when she did not receive a stipend.

Mandy

Mandy joined the tutor programme in March 2022. She is 20, matriculated in 2021, and passed Grade 12 mathematics with 39%, and her home language is isiNdebele. She stayed with her grandmother, mother and siblings in the local village. Her grandmother has epilepsy, and she is responsible for her physical caretaking. She is unemployed and not studying or working part-time. She participated in the tutor programme for which she received a stipend. She used her stipend to support her family financially and did not receive money from her mother during the months when she did not receive a stipend.

3.5.3. Data collection strategies

The research design for this study is a layered case-study design, as described in section 3.4.3. The study's conceptual framework described in section 2.8 directed the data collection strategies. I designed, developed and implemented the mathematics intervention model before I started my study. The implementation of the model started in 2020, and I started my study in 2022, gaining approval and ethical clearance in 2023. From 2020 to 2022, I submitted monthly progress reports to the mine from February to November every year. By the beginning of 2023, when I gained approval and ethical clearance, I had written more than 30 reports containing information on the mathematics intervention model and the tutor programme. The information in the reports was based on my interpretation of data I collected from 2020 to 2022. This data were collected through formal and informal group and individual discussions that formed part of the tutor programme's training. During this time, I also gave the tutors questionnaires on their experiences of the programme to report to the mine's management. As part of my role as the implementer, developer and designer of the mathematics intervention model and tutor programme, I continuously observed the tutors' experiences during all programme activities.

By the time I started my study, I had already accumulated data on my conceptual framework's constructs for each tutor. I decided to study data "in arrears" (post-hoc)

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and use it as my data set. Still, I did not know if my data were complete, i.e. whether I had sufficient data on all the constructs for all the tutors. Therefore, I decided to sort all the data I had per tutor and construct to determine what data I already had and still needed to collect. I used the data I collected from 2020 to 2022 and conducted further interviews in 2023 to collect the still-needed data. I then conducted semi-structured interviews with the tutors where I needed to fill the 'gaps' to complete my data collection process and build an in-depth case study for each tutor.

a)   Document analysis

As explained in section 3.5.3, I studied data "in arrears" (post-hoc) because I accumulated written data on my study's conceptual framework's constructs before starting my study. Nieuwenhuis (2020) points out that written sources may be in printed or digital format, adding that they may include "any documentation that is connected with the investigation" (p. 101). I performed a document analysis on all the written data sources that contributed to answering my research questions for my data gathering. In my case, I used three years of questionnaires that I gave the tutors to report the programme's progress to the mine's management which funded the implementation of the model. All these documents were primary sources because they were, as described by Nieuwenhuis (2020), the original source documents. Bowen (2009) defines document analysis as the reviewing of documents generated without the researcher's involvement. However, I was involved because I designed, developed and implemented the intervention model and was responsible for writing the monthly progress reports I submitted to the mine's management. I also designed the tutors' questionnaires to obtain feedback on how they experienced the programme for these reports. The interpretivist paradigm applied to my study, acknowledging that my interpretation and beliefs influenced the results, and I implemented the relevant measures for my study to achieve credibility, as discussed in section 3.6.

b)   Semi-structured interviews with field notes

I conducted one interview per tutor with the tutors I needed to collect data from to complete my data collection process. The interviews were done on a one-to-one basis, and I recorded them with the permission of the tutors. I used field notes during all my interviews to record my observations and impressions of the environment or

interactions during or after the interviews providing essential context for the data analysis (Nieuwenhuis, 2020). I recorded field notes electronically (using my cellphone). I chose semi-structured interviews to complete the data collection process because I needed to ask "why" questions, explore participants' independent thoughts about their experiences of the intervention model and obtain detailed information about each tutor's case (Adams, 2015). Before the interviews, I developed a list of open-ended, probing questions that I asked, followed by questions that further probed and clarified (Nieuwenhuis, 2020). During my interviews, I was aware of participants' reactions to my questions to identify new lines of thought that could contribute to my study, and which I needed to explore (Nieuwenhuis, 2020).

c) Questionnaires

I collected data using questionnaires with a combination of closed structured questions and open, unstructured questions. During my data analysis process, I realised that most of the answers to the closed questions did not contribute to answering my research questions. I used most of the answers to the open, unstructured questions for my data analysis. The answers to the open questions were more difficult and time-consuming to analyse, but as Maree and Pietersen (2020) point out, there were a lot of advantages to using these open questions. Tutors gave honest and detailed answers, revealing their thinking processes. They answered complicated questions sufficiently and the thematic analysis I used to analyse tutors' responses revealed interesting information.

3.5.4. Data analysis

I employed a qualitative content analysis strategy to analyse the data for this study. The data were all textual sources. I sorted and arranged the textual sources in MS Excel into the conceptual framework's constructs. I used an MS Excel worksheet for each main construct. I arranged the tutors' names in rows with a column for each sub-construct in each worksheet. After this, I wrote the tutors' reflections in the voice of each tutor in section 4.2 of Chapter 4. At the end of each tutors' reflections, I prepared a circle diagram summarising each tutor's experiences, condensing four to five pages of data into one diagram. While writing section 4.2, I analysed the tutors' responses to identify patterns and themes within each construct (Stemler, 2015). I used the data

under investigation to develop the patterns and themes that emerged from the data (Braun & Clarke, 2006) without particular ideas in mind. Stemler (2015) refers to this process as "emergent coding" (p. 3). While developing the themes, I recorded them in an MS Excel worksheet, sorting them under each of the 11 sub-constructs (Barnes, 2004). After this, I refined the themes by identifying sub-themes and main themes. For example, if some tutors indicated that they did not know that division was about grouping (sub-theme) and others said that they thought division could only be solved using the long division method (sub-theme), I created a main theme titled "The programme changed my understanding of division" and categorised all tutors' responses describing how their understanding of division changed about various aspects of division, into this main theme. Then I used the data analysis software Atlas.ti to create codes for each main theme. I imported section 4.2 of Chapter 4 into Atlas.ti and assigned these main theme codes to all the tutors' responses. If a tutor's reflections included responses on various sub-themes belonging to the same main theme, I only counted it as one response under the main theme. Although the study was qualitative, I quantified tutors' responses for a particular theme by counting the number of tutors' responses for a particular theme to analyse which themes were more prominent. In doing so, I created the tables in section 4.4 of tutors' responses to the main themes to summarise my study's findings and answer the four sub-research questions.

3.6. Methodological Norms

When working with qualitative data, the criteria for demonstrating the trustworthiness of the study's data analysis, findings and conclusions are credibility, transferability, dependability and conformability (Nieuwenhuis, 2020). To achieve credibility, I had to ensure that my data agreed with reality. Nieuwenhuis (2020) discusses several strategies to ensure credibility, referring to well-established research methods and aligning the study's research questions to a suitable research design and overarching theoretical framework. My qualitative methodology was aligned with my research questions, asking "how" tutors experienced certain aspects of the programme and "what" their experiences were. My choice of socio-constructivism as the approach in my study was also aligned with the case-study design I used to collect the data on tutors' participation experiences. Nieuwenhuis (2020) further explains that with all

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these credibility measures, credibility can be enhanced through closeness with the participants. As the designer and implementer of the programme, I worked closely with the tutors for three years. The tutors were familiar with sharing their thoughts with me, which helped them to share their true experiences during their interviews, enhancing credible responses. A case-study design was chosen for the study, which could not be generalised. However, I provided sufficient contextual information to enable readers to make a transfer by connecting elements of the study to their own research (Shenton, 2004). I addressed dependability by documenting and reporting the study's processes in detail so that a future researcher can repeat the work and arrive at the same interpretations (Shenton, 2004). I aimed to achieve conformability by demonstrating how and why I made decisions throughout the study (Nowell et al., 2017).

3.7.   Ethical Considerations

At the University of Pretoria, the Faculty of Education Ethics Committee approves the research protocol of all research proposals through its Ethics Application Process and Procedure. This committee assessed the application for this study and approved the fieldwork. Throughout the study, the research was guided by ethical guidelines. The principle of voluntary participation applied. I made it clear to the tutors that they were not obliged to participate in the study and that there would not be any consequences when they withdrew from the study. All of them were given informed consent, and I explained the study's goals and nature. I treated their identities and responses as highly confidential and will not make them available to unauthorised users. They were assigned pseudonyms to give them anonymity and protect their dignity and privacy. Plagiarism was avoided, and honesty was considered throughout the research process. I familiarised myself with the university's policies and procedures for responsible, ethical research.

3.8.   Conclusion

The epistemology of this study was based on a constructivist ontology. Tutors' experiences were socially constructed, a subjective construction of reality. The interpretivist paradigm applied to the study because I derived meaning from human experiences, and my interpretation and beliefs influenced the results. A qualitative methodology was used to acquire new knowledge. The research design was a layered

case-study design that allowed an in-depth analysis of tutors' experiences and combined the studies of individual tutors into a single case to evaluate the tutor programme. I studied two populations: rural primary South African schools and unemployed youth who passed mathematics in Grade 12. The samples chosen for both populations were purposively selected. The rural primary school sample was chosen because the mathematics intervention model was implemented in this school, and the selected tutors participated in the tutor programme. I implemented the model at this school for three years and the data for this period was collected "in arrears" (post-hoc). I analysed the post-hoc data to determine if I had sufficient data on all the constructs for all the tutors. I then conducted semi-structured interviews and used questionnaires to collect the still-needed data. The data analysis generated themes and sub-themes that were not anticipated, and the thematic analysis was the most suitable choice for analysing the tutors' responses. A trustworthy thematic analysis was conducted to ensure credibility, transferability, dependability and conformability. Ethical principles were followed throughout the entire research process. The purpose of the inquiry was investigative, and the study can benefit the implementation of the model in its current location, as well as other similar tutor-based interventions.

Chapter 4: Data analysis and findings

4.1. Introduction

I started this chapter by analysing each tutor's experiences in section 4.2. I included the voice of each tutor[1] in my descriptions. I analysed the tutor's experiences, explicitly differentiating between the three main constructs of the conceptual framework: 1) the tutor's learning experiences, 2) teaching experiences, and 3) personal experiences. I further opted to distinguish between the sub-constructs within each main construct. There were 11 sub-constructs in total for the conceptual framework (see *Figure 2.3* in section 2.8). At the end of each tutor's reflections, I summarised them in a circle diagram, condensing four to five pages of data into one diagram. I designed these circle diagrams as an at-a-glance visual illustration, showing a high-level summary of each tutor's experiences. After the diagrams, I described the salient points of each tutor's experiences.

In the next section, I discussed the findings for the tutors' experiences I analysed in section 4.2. I followed the same structure I followed when analysing their experiences. I discussed the findings differentiating between the three main constructs of the conceptual framework: 1) the tutors' learning experiences, 2) teaching experiences, and 3) personal experiences. Again, I further distinguished between the sub-constructs within each main construct. As previously explained in section 2.8, I developed the conceptual framework to answer the four sub-research questions of my study and, in this way answered the main research question. *Figure 4.1* on the next page illustrates how my conceptual framework is linked to the four sub-research questions and, ultimately, the main research question. The findings for sub-constructs 1-11 answered the first three sub-research questions. Then I worked through the findings for all the sub-constructs to answer sub-question 4. In this way, I answered the main research question.

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[1] The tutors were not first-language English speakers. Grammatical corrections to tutors' responses were only made when meaning was adversely affected.

Figure 4.1

The conceptual framework and the study's research questions
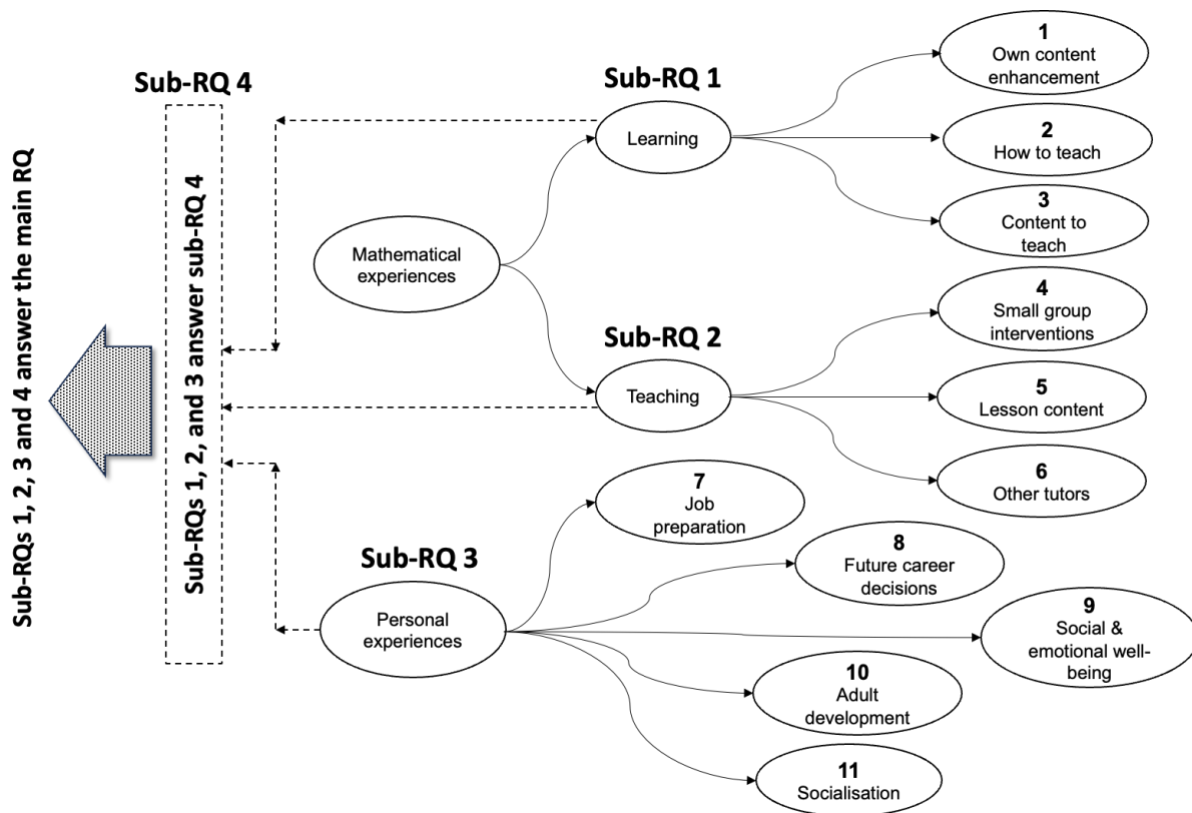
4.2. Analysis of tutors' experiences

4.2.1. Sihle

a) Sihle's learning experiences

<u>Learning own content enhancement</u>

Sihle explained that learning mathematics in the tutor programme improved her problem-solving, reasoning and critical-thinking ability. In school, she thought solving a problem was doing the steps correctly. Her mathematical experiences in the programme showed her that although mathematics was full of problems, she could use critical thinking to find different solutions. She stated: *"The development of reasoning to solve problems is the best thing I have learnt in this programme. The way we deal with problems."* She also learnt that there is more than one way to solve a mathematical problem and she realized that she could also create her own methods to solve those problems. She stated*: "It helps me to think logically about the world and*

to reason logically. I also learnt that the same steps I take to understand a problem, identify everything and then solve it can be applied to other things in my life." She explained that she thinks our daily lives are full of mathematics, requiring us to think critically and find different solutions. She described her experience learning mathematics as: *"It also helps me make decisions that can help me to achieve my goals."* She experienced multiple examples in mathematics which helped her learn and improve her understanding and encouraged her to develop alternative solutions. She explained that the programme changed her perception of learning mathematics: *"I thought learning [mathematics] was about textbooks and teachers telling us what to do in mathematics. The programme changed it when we used cards and counters with different colours, playing different games and watching videos to learn."* She also discovered how the four operations worked together (addition, subtraction, multiplication and division). She said: *"The four operations have connections."* She never knew that multiplication was repeated addition. She also learnt that multiplication and division were inverse operations, and the same applied to addition and subtraction; they are also inverses of each other. She further described: *"In school, I thought using a calculator is the only way to solve the problem. The programme changed it when we were doing worksheets without a calculator, using what we learnt and what we know to solve the problem."* She now believes anyone can be good in mathematics with *"dedication, practise and the right tools and resources".*

<u>Learning how to teach</u>

Sihle learnt the importance of considering learners' different learning styles when teaching. She explained: *"Learners have different styles of learning, so tutors must present content in different ways to achieve goals".* She added that it taught her patience and understanding when working with learners with different abilities. She feels she learnt to appreciate learners as individuals and explain concepts well. She stated: *"It is all about making the learning experience as enjoyable as possible."* She also responded that she learnt time management while learning how to teach, stating that: *"We were able to help the learners progress very well despite working under pressure. We learnt to manage time."*

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Learning content to teach

For Sihle, learning the content to teach in the lesson plans *"is like preparing for writing exams",* and she is very positive about it, saying that *"it's a good thing that we always have to do."* She likes the lesson plans and thinks they are very good. When asked if there was anything particular about them, she responded that she liked the steps in the lesson plans. She explained that the day before she gives her lesson, she studies to teach her lesson and gets prepared. She further explains: *"Sometimes when I learn the lesson at home, I feel uncertain when there are questions or sums that I don't understand, and I will be unsure about what I am going to teach, but the next day when we are doing the tutor training session that is resolved."* She said she learns a lot during the tutor training sessions preceding learner intervention sessions because *"tutors share information and strategies and suggest new things".* The discussions during the tutor training sessions are *"very important"* to her. She responded that it is *"good when a tutor is asked to show the other tutors how they would present their lessons because we [the tutors] are not the same, and I will see something the other tutors do that could help me with my lesson".*

b)   Sihle's teaching experiences

Teaching small groups

Sihle experienced tutoring small groups as a very *"comfortable environment that boosts the confidence of all of us [tutors and learners]".* She said it allowed her to work closely with each learner; teaching one-on-one situations and noticing who was struggling so that she could help them. Her experience was that it made it easy for her to ask the learners questions to see who was struggling. She explained: *"It provides the opportunity to analyse learners' strengths and gaps in their development."* What she liked the most about the small group environment was that she thought it encouraged tutors and learners to achieve their best. She felt that in this way, she knew when to intervene so that the learners could improve and both tutors and learners could benefit from this environment.

Teaching the lesson content

According to Sihle, tutors must incorporate multiple steps when teaching their lessons, and to do this, she believes that they (the tutors) must be able to work completely self-

sufficiently. She discovered that teaching mathematics is more than just about numbers and symbols; it is about understanding how to solve problems." She explained: *"Teaching the lesson content involves learning the correct language, solving problems and having experience."* She described the best lessons as the ones that had content relevant to learners' everyday lives and experiences. Her view of the content was that it considered every learner because it consisted of *"visual, auditory and concrete representations, which take every learner into account."* She is convinced that using the cards and counters to teach the lesson content significantly influenced learners' progress. She responded: *"The children learnt and improved mainly because the counters and the cards worked so well, especially for the learners that could not count. The cards and the counters are practical. The counters and the cards also helped me when I used them. It brightened my day when I started teaching the learners. It makes learning more memorable for the learners. I learnt that the things we use to represent sums, numbers and calculations, like counters, cards with colours and games, really have a huge impact on the learners' progress. I did not know that visual things could make such a big difference. It brings much light to all of us."* Sihle believed that tutors were there to help learners and that it was important to try new things if something was not working well to achieve this goal. She explained that she liked the games that formed part of the lessons because, during games, learners do not write in their workbooks but learn to understand things by practising them.

Teaching with other tutors

Sihle's experiences teaching with other tutors were not very positive. She stated: *"Some [tutors] are too playful, and some don't have manners."* She felt that although the lessons were straightforward, some tutors complicated them *"because they want attention"*. She further explained: *"When some tutors do that, it sometimes disturbs others, and it disturbs me because I understand the lesson."* She admitted that although tutors sometimes made things worse, they also helped each other. Sihle explained that when tutors shared and talked about things while going through their lessons, they made decisions together. In this way, she felt tutors always participated in the decisions taken in the programme.

c) Sihle's personal experiences

Job preparation

Sihle experienced that the tutor programme prepared her for a future job, because of the significant influence it had on her overall development. She believed the programme taught her to plan, prioritise and execute daily tasks. She also felt she could work in a team and as an individual *"in a professional and empathetic manner with and without supervision. It [the programme] encourages me to do something in life to fulfil my aspirations."*

Future career decisions

Sihle indicated that the tutor programme did not influence her future career because she does not want to become a teacher one day; she wants to obtain a qualification to become a paramedic. However, the tutor programme influenced her future by teaching her an approach that helped her to achieve her goals and dreams.

Social and emotional well-being

When Sihle was asked how she felt about the tutor programme, she responded positively: *"I am having a great time in the tutor programme. Every time we meet, it is a good thing. When we are here, there are a lot of things that are happening that make me happy with the learners and with the other tutors and it becomes a good thing to be here."*

Adult development

Sihle indicated that the tutor programme positively influenced her adult development, experiencing personal growth. She explained that although she is teaching and busy with the learners, she grows. She said: *"The programme improved my self-esteem, and I became independent and hard-working. It also encouraged my level of thinking, discipline and time management. I now have a strong desire to educate children positively. I am greatly concerned about other schools around me. I feel that as a tutor, I can give something to my community."* She also stated: *"The tutor programme develops many skills, and it is really a good thing and a great opportunity to be in this programme."* She continued to refer to the skills she acquired in the programme saying: *"The skills I developed in the programme gave me the courage to change a lot of things in my community involving people, learners and schools. I can teach them*

things that they need to know. I can also use these skills outside of my community if needed." She discusses how the programme taught her to set and achieve goals. She explained: *"I learnt that goal setting helps you keep going on the right track. It becomes very easy to feel successful when you work on your own path. It keeps you very focused on what you want to achieve in life."* Her experiences solving mathematical problems influenced her approach to solving problems in her life, helping her to achieve her goals and dreams. She added:" The *tutor programme teaches me to work extra hours or days to achieve goals."* As far as being a mother is concerned, she feels that the programme taught her to be a good mother because it taught her to understand children. It influenced her thinking about her son's mathematics at school, which she now pays attention to every day when he is doing homework.

Socialisation

Sihle explained that the tutor programme taught her to prioritise connecting with others. She explained: *"We are always sharing and talking via social networks. We check up on each other and are updated about some things."* She indicated that the tutor programme improved her knowledge because she learnt valuable interpersonal skills, like communication and listening.

d)   Summary of Sihle's experiences

The following circle diagram captures the experiences that dominated Sihle's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.2

Summary of Sihle's learning, teaching and personal experiences
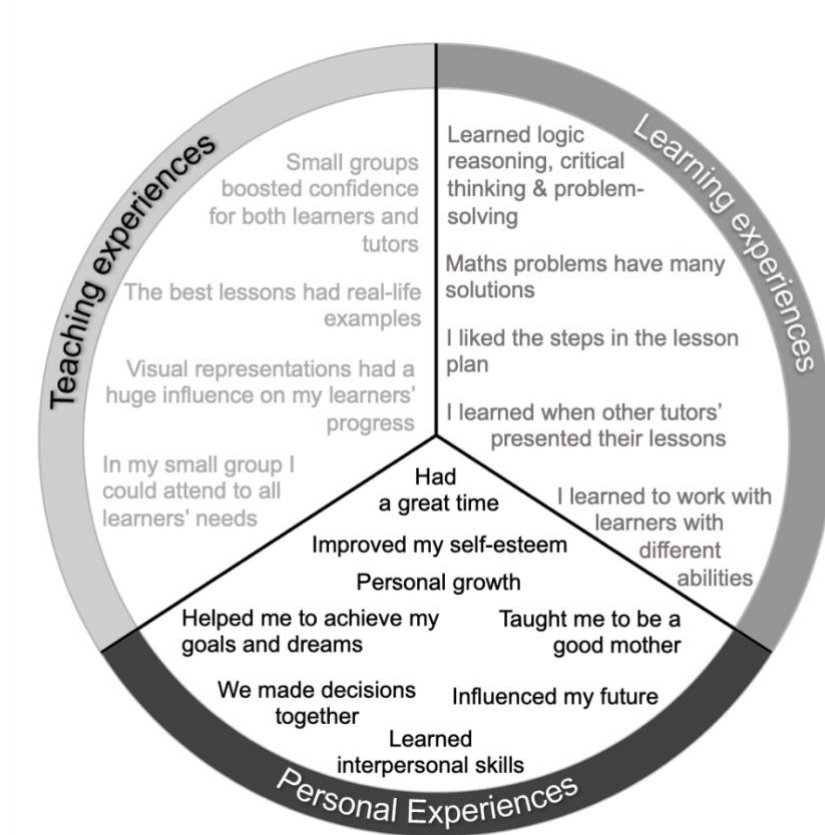
e) Salient points in Sihle's experiences

Sihle's teaching experiences that stood out in her discussions, were discovering the significant impact of using place value cards, counters, games and other visuals during lessons on learners' understanding of mathematics. She claimed to have learnt many different skills in the tutor programme. However, her learning experiences solving mathematical problems had the most significant impact on her life. It taught her problem-solving, reasoning and critical thinking and that there are multiple ways to solve problems. She applied these principles to the world around her, becoming focused and goal-orientated in her personal life. This led to personal growth, which improved her self-esteem, also affecting other aspects of her life, such as helping her become a better mother.

4.2.2. Towani

a)   Towani's learning experiences

Learning own content enhancement

Towani's experiences in the programme showed him the importance of building a strong mathematics foundation during a child's early years. He explained: *"I learnt that building the foundation of mathematics in the early years is very important. If we only attend to mathematical problems in secondary school or FET phase, building the foundation at this stage can be challenging."* Towani described how the programme improved his mathematical knowledge. He gave the example that he would never have considered using all four operations (addition, subtraction, multiplication and division) to solve one problem, until he learnt it in the tutor programme. Another example was the 'big 7 approach' for dividing multi-digit numbers. This was new to him, and he preferred it in the place of the long division method, which he said: *''This is a confusing method and difficult to follow.''* He also gave the example that he never realised that division is also based on grouping, and that he had only ever thought about division in terms of the long division method (which is the format, not the understanding thereof), he was familiar with. He said that in school, he always thought following steps to solve mathematical problems meant that you understood the problem. The programme changed it: *"There is a difference between understanding and just following a certain method. You can follow a method but not understand what you are actually doing."* He said he realised: *"If you can write something well but can't explain what you are writing it means you don't understand it."* Using pictures to understand mathematics also made an impression on him when he said: *"In school, I learnt to solve a problem by writing numbers. But now I know you can use pictures to make things much easier."*

Learning how to teach

During discussions with Towani, he explained that as a tutor, he learnt that he had to deal with diverse learners, accommodating everyone and adapting to their needs. He felt he needed to ensure every learner learnt something in his lessons. He explained: *"You will teach something in a certain way. When you are finished, only to find out that maybe two learners don't understand, and you must make changes so that they also understand. Maybe you were talking too fast, and you must repeat it slowly, bit by bit, so that they can understand. So, I must realise that for these learners when I am saying*

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something in this way, they don't understand, but when I am saying it that way, they do understand. It is also the language. When I use English, these two [learners] understand, and when I use isiNdebele, these five also understand.” He claimed that this resulted in him being *“a person who can now describe things well.”* For Towani, creating a conducive environment when tutoring the learners was important. He explained what he meant by this: *“It is that I will create an atmosphere where the learners will be able to cooperate with me and ask me questions where necessary and have an environment where the learners won't be afraid.”* He described how he experienced fear in his younger grades, not asking questions, only sitting quietly in class. He is determined to prevent children in the following generations from experiencing the fear he had. When asked how he achieved this in the tutoring sessions, he answered: *“I tell them [the learners], when you have a question, don't be afraid to ask. Ask, and I will answer. After I explain something, I will always ask who has a question. Don't be afraid to ask. So, I am open to them [the learners] so they can feel we are here to learn. So that the learners feel that the person teaching them wants them to learn.”* He felt it worked because he claimed his learners always asked questions during sessions.

Learning content to teach

Towani experienced that he needed to write his lessons on paper to learn and present them well. The day before tutor sessions, he read and then wrote down the lessons and asked himself questions about them: *“Then I ask myself questions to say how do I do this, why do I do this, and what makes me think that I must do this?”* He felt that he was well prepared for his lessons, and when he attended the tutor training, it was only a revision. He stated: *“The training is confirming what I have. I have interpreted something in this way, but it is actually in that way. Is it correct, or did I understand it another way?”* He further explained: *“I will be able to do the lesson without the tutor training, but sometimes the training the next day helps me because it will give me different points of view. I could have seen something this way, only to find out that somebody else is seeing it in another way, and it's simpler than I have seen.”* He also felt it helped him when other tutors presented their lessons during the tutor training sessions. Seeing what other tutors did to achieve the same objectives in the lessons sometimes showed him new things he had not thought of. He realised that if some of

the learners in his group did not understand, he could use these alternative approaches when presenting his lessons.

b) Towani's teaching experiences

Teaching small groups

Towani claimed that teaching a small group gave him confidence in being a tutor. His idea of a big class was that it was noisy, and he could miss the content to teach. He felt that he could manage small groups, and he could _"see each and every learner work and develop some strategy on how to improve the performance for that learner. You can ensure that every learner is doing his/her schoolwork."_

Teaching the lesson content

Towani experienced that when he represented (he used the word _"displayed"_) the same concept to learners differently, they were happy because they had options. He also experienced that, apart from different representations, he also had to explain the same concepts differently when he taught the lesson content. He said: _"You must instigate [initiate] new things [explanations] in the lesson and prove them to be your alternative way when they [the learners] don't understand."_ He referred to the learner interventions on multiplication and division and stated: _"Teaching multiplication and division together was one of the things that worked the best."_ He also believed teaching division as grouping worked well (as mentioned previously, he never thought division was also grouping).

Teaching with other tutors

Towani had positive experiences teaching with other tutors because he liked to collaborate with other tutors. He claimed that he listened to different views from his _"partners"_ (other tutors) and tried to use their advice when tutoring the children. He said_: "When it [their advice] does not work, I develop my own by using their views. So, I combine many things to be a single thing and then give it to the learners. This keeps my mind active and reminds me that I am capable and can do more."_ Towani claimed that he learnt so many things working with the other tutors, but what stood out was that working in unity makes things easy. He believed the other tutors were his colleagues and friends and that he could rely on them when he had a problem,

particularly when he needed help dealing with learners. He felt that the tutors' reflective discussions after the learner interventions, when tutors gave feedback on their lessons, pulled them closer as a team because they shared their challenges. He said: *"That is when we realise what have you [the tutor] faced during your lesson … and that's when we discuss how we can overcome that … that discussion pulls us closer because you are sharing your challenges."* Towani expressed his concern that at times, tutors were too excited (he used the word "*hyper*") and then there needed to be a balance. He felt tutors must be more open, sharing their personal problems with each other. He experienced tutors having angry outbursts over minor issues, and he is convinced it happened because they dealt with difficult situations at home. He explained: *"Sometimes, as a team, we don't always know what is bothering someone. To make that better, we can be open to each other and talk to each other if something is not going well."*

c) Towani's personal experiences

Job preparation

Towani believed the tutor programme prepared him for a job. He learnt that through teamwork, the sharing of responsibilities made tasks easier, and in this way the group performed well and could finish things on time. He further explained: *"The programme also taught me communication skills, listening attentively and responding effectively."* He felt the programme helped him break complex problems into smaller pieces and find solutions through communication.

Future career decisions

The tutor programme influenced Towani's choice of a future career. It encouraged him to become a qualified teacher one day. He is currently (in 2023) enrolled for a Higher Certificate in Education at UNISA as an access route into a Bachelor of Education (BEd). He explained: *"I can see how important it is for me to invest in education because the main key in the fourth industrial revolution is being educated. You can only change poverty through education."* He also said he used the experiences he gained in the tutor programme to answer questions in his UNISA assignments. When Towani was asked whether he would prefer to teach at a rural, urban or city school one day, he answered that he would prefer a rural school. He believed that children

from rural areas miss important activities and experiences due to their economically disadvantaged backgrounds. He explained that he wanted to teach at a rural school because *"our education system treats them [rural children] the same as urban and city children, so I mean they [rural children] are the ones who need more time [and attention]"*.

Social and emotional well-being

Towani indicated that the tutor programme makes him happy. When asked why it makes him happy, he responded: *"The programme makes us happy because we are learning from each other. Learning makes me happy."* He felt he had a say in the decision-making processes to solve problems in the programme. The reason is that during the tutors' reflective discussions after the learner interventions, they gave feedback on their lessons to the rest of the tutor group discussing the challenges or solutions they encountered during their lessons. He explained: *"When I am giving feedback, I can say I saw, or I found this or that. This makes me feel part of the decision-making."*

Adult development

Towani experienced the tutor programme as positively influencing his development as an adult. He believes the programme developed his skills and capabilities to deal with people, particularly interacting with children. He stated: *"I want to use these [skills and capabilities] to change other people's lives and make sure that if I am no longer here, they will still remember it. I want to pass the knowledge and skills I gained from the tutor programme to the next generation."* He claimed that the tutor programme motivated him to help vulnerable communities and *"put them on the map so they can access quality teaching and education"*. Towani explained that he learnt that he could achieve many things if he kept putting all his efforts into what he was doing. He said: *"I have also learnt that you can invest time in something, but it will not immediately give you the best results you expect. So, good things take time and patience. I will start teaching my child maths at a very young age"*. Towani felt he had experienced many things he had not been exposed to before since participating in the programme. He described these experiences: *"I experienced that when you do this, it becomes this or that. If I take this way, I get a mind to show me it will go towards this direction."* In other words, he experienced that his actions would lead to specific outcomes and that

he must think about and figure out (*"… get a mind to show me …"*) the future direction in which certain decisions would take him.

d) Summary of Towani's experiences

The following circle diagram captures the experiences that dominated Towani's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing his essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.3

Summary of Towani's learning, teaching and personal experiences
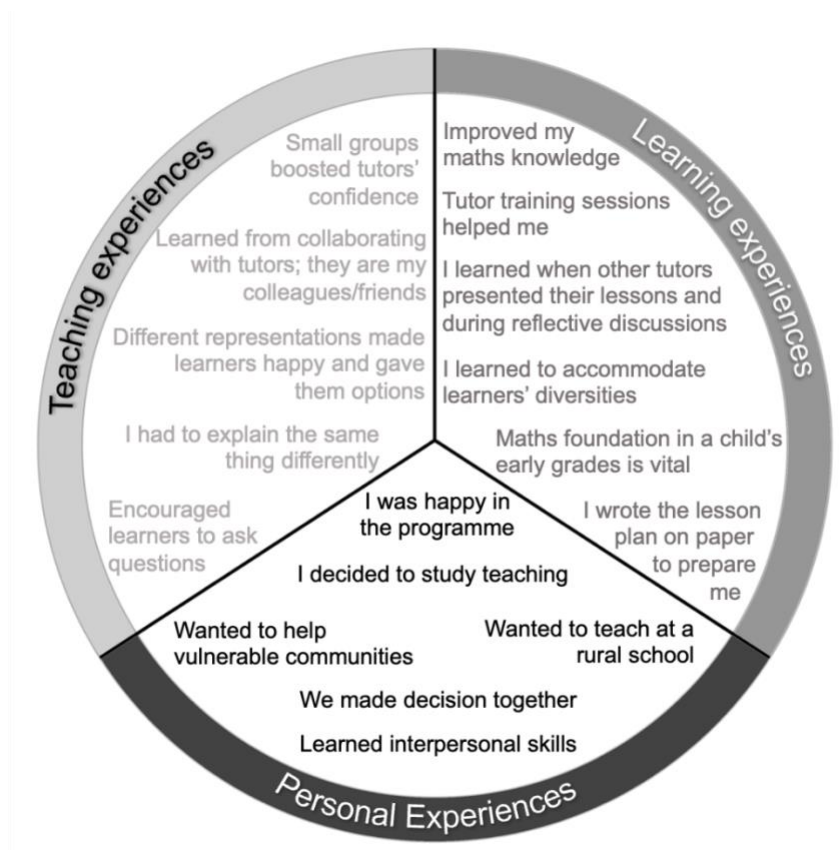
e)   Salient points in Towani's experiences

Towani's teaching experiences in the programme in 2022 significantly influenced his future when he decided to pursue teaching as a career. This led to his enrollment at UNISA in 2023, studying towards a Higher Certificate in Education. During discussions with him, it was evident that he was passionate about educating future generations. His learning experiences of how the tutor programme improved his mathematical content knowledge were also prominent. He demonstrated how seriously he took his learning experiences, by writing each lesson on paper and asking himself questions about the lesson content before presenting it (all tutors received their lessons on Whatsapp the day before presenting them). He was the only tutor in the group doing this. It was further apparent how open he was to learning, allowing his teaching experiences to be enriched by other tutors' views on how to deal with the learners. Lastly, it was noticeable how his teaching experiences focused on accommodating learners' diversity and ensuring that all the learners in his group understood his lessons.

4.2.3. Pemma

a)   Pemma's learning experiences

Learning own content enhancement

Pemma's mathematical experiences in the programme showed her that mathematical problems could be solved in many ways. She said: *"Maths needs an overthinker."* She also learnt that there are many ways to write these solutions. She explained that when she learnt the programme's mathematical content, she *"had to take her mind back to Grades 4 and 5 and practise her maths, especially fractions."* She discussed how she enjoyed the mathematical challenges during tutor training sessions that developed tutors' mathematical knowledge. She referred to the jellybeans tutors received when they competed in teams to solve mathematical problems: "*The [mathematical] exercises and the prizes like the challenges, the jellybeans and the games. It is maths, but it is fun, you enjoy it. It makes a big difference. This programme is not just about tutoring the Grades 4 and 5 learners but about the fun exercises we do."* This led to her believing that nothing is impossible in mathematics and that there is no wrong way to get to the answer. Her view is: *"It's a game you can solve [a mathematical problem] in many ways."* However, she realized that the importance of solving mathematical

problems was understanding the steps to solve them and why you are doing them. She gave an example of subtraction problems: *"At school, I was taught that it was impossible to subtract a bigger number from a smaller number [when using the vertical method for subtraction].* She explained how the tutor programme changed this when she learnt that she should focus on understanding the subtraction problem as a whole and not only the subtraction of one digit in the problem. She also learnt the importance of expressing your thoughts when solving mathematical problems: *"At school, I thought that as a learner, you don't have to tell your teacher what you think or what comes into your mind when you see a certain maths question. The tutor programme changed it when it was explained to me that it is very important to allow the learners to show you what they see so that you [as a tutor] will know if the learners do not understand."*

Learning how to teach

She claimed that the tutor programme taught her to be consistent and patient when tutoring the learners. She said that she learnt how to deal with learners with different emotions. She explained that she faced challenges while teaching but *"learnt to first digest it and deal with it in a very calm way."* She also explained that during her tutoring sessions, she experienced how she sometimes had to come up with new ideas to help a struggling learner.

Learning content to teach

Pemma claimed she never knew that Grades 4 and 5 learners could use different strategies to solve mathematical problems. She described that one of her learning experiences was discovering how division, multiplication, addition and subtraction work together: *"I find it fun and amazing."* She explained that she learnt the content to teach by reading through the lesson plan and trying to understand it when she received it on the Whatsapp group. Her view of the lesson plans is: *"Because the way they [the lesson plans] are written makes it easy for me to understand that this is how we were going to solve the problem. This is [the lesson plan shows] how I will present it in class to the learners. I like everything about the lesson plans; the structure and the pictures. I am a visual person, and the photos help a lot."* Based on how she perceived her learners' abilities, she would then consider how they would understand it and think of how she would explain it to them. She felt that the tutor training sessions before learner

interventions helped her because *"I try things out, and then sometimes we ask you in the group that ma'am this needs you to be discussed with you, is it going to work like this, or should we do this."* She felt that when a tutor was asked to present the lesson during the tutor training session, it helped her: *"I had my ways on how I am going to teach my learners and when he [another tutor] starts to explain it to us, he gives me one or two tips. I can take this [the tutor's advice] and use it."*

b)   Pemma's teaching experiences

Teaching small groups

Pemma believed she could *"grab the learners' attention"* in small groups. She also felt that it is easier to control a small group. She explained: *"Although some learners get used to you and become unruly, it [small groups] are helping because, as a tutor, I get to see which learner needs extra attention."*

Teaching the lesson content

Pemma felt: "*Teaching the lesson content is simple for me as I have prepared for it."* She described her teaching experience: *"Making maths easier for the kids is not only about solving problems but also seeing them making mistakes."* She believed the place value cards and counters significantly influenced learners' progress.

Teaching with other tutors

Pemma experienced that teaching with other tutors worked well because they solved problems together: *"Learners were struggling, and every week we had to come up with different ways to present the same lesson. It worked well that we sat around the table and worked together as tutors to come up with new ideas to change one or two things."* She saw the other tutors as her friends, "*who were like a small family, a cosy genuine loving and caring small family."* She felt that she did not always have a say in the decisions taken in the programmes because most of the tutors in the group did not see or interpret a lesson in the way she did. Then a decision was taken based on the majority of the groups' opinions.

c)   Pemma's personal experiences

Job preparation

Pemma felt that she had gained work experience in the tutor programme, which prepared her for a job. She explained: *"In the tutor programme, we are professional and do not mix business with personal matters. This helps me to be disciplined and handle matters differently."* She believed that the programme helped her to be very organised, plan and to be punctual. She explained that it taught her to always look for new ways to solve problems and to be determined: *"Being determined about everything that I do no matter how small that thing can be. I have realized that nothing is actually impossible if you put your mind to it."* Pemma discovered the value of teamwork and the importance of communicating effectively. She said the programme helped her to realise that people's thoughts are not the same: *"I must understand that people are different and have different ideas."*

Future career decisions

The tutor programme influenced Pemma's future career decision because she wanted to become a qualified teacher one day. She explained: *"I tried to apply at UNISA to study teaching but unfortunately didn't get admitted. I, therefore, ended up doing HR for the time being. However, I will keep applying again and hope to get admitted."* She used the tutoring skills she developed in the programme to tutor other learners: *"I am also hoping that my own tutoring will work out. I am staying around town and already have kids I am tutoring."*

Social and emotional well-being

Pemma described the tutor programme's contribution to her social and emotional well-being: *"Being a maths tutor made me develop a love for math. It also contributed much to how I plan and sometimes analyse my things. I now look at problems in many different ways and come up with possible different solutions to solve them."* In this way, she felt that the programme positively influenced her social and emotional well-being.

Adult development

Pemma felt that the tutor programme positively influenced her development as an adult. She explained that the programme helped her realise her potential. She said: *"The programme has influenced my life in a positive way. At some point, it taught me*

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patience, to be humble and understanding." She believed that she learnt to be passionate about what she was doing and stated: *"I have developed a passion and realised that whatever I do has to come from the bottom of my heart*." She recognised that she was not punctual, but during her participation in the programme, she realised that she should be disciplined with time and that she must respect time. She acknowledged: *"It is something that I am practising everything. We have to be punctual."* She claimed that the programme also influenced her as a mother: *"When it comes to my daughter one day, I must not be hard on her, but let her explain to me how she sees things."*

Socialisation

Socialising with the other tutors played a significant role in Pemma's life, and she described: *"I have made really close friends in the tutor programme. We have become so close, like brothers and sisters."*

d)   Summary of Pemma's experiences

The following circle diagram captures the experiences that dominated Pemma's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.4

Summary of Pemma's learning, teaching and personal experiences
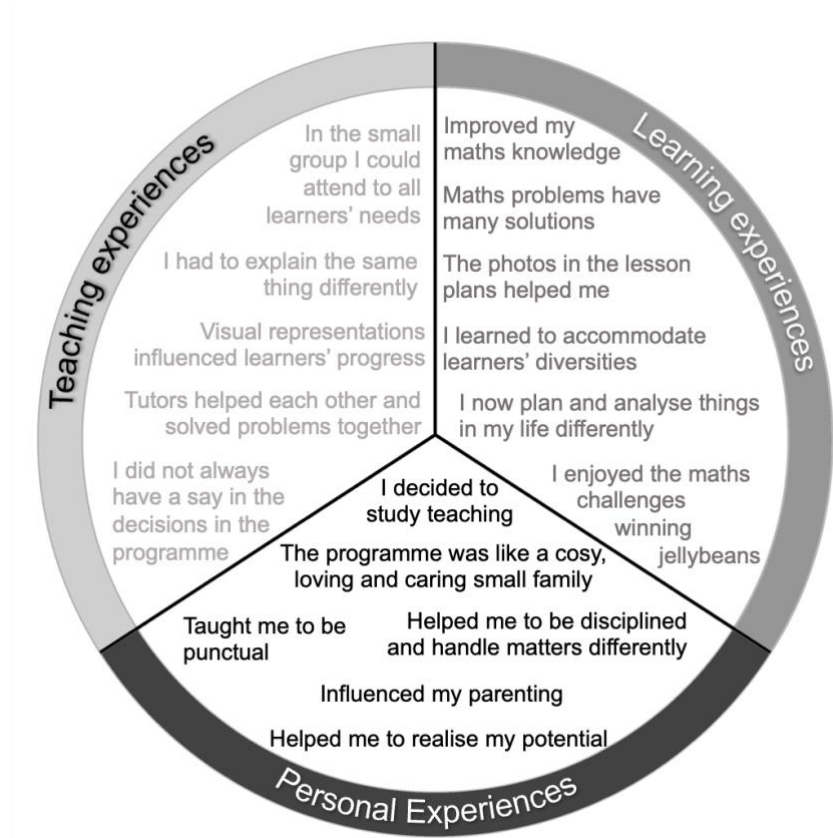
e)   Salient points in Pemma's experiences

In analysing Pemma's learning experiences, it was evident that the programme did not only improve her mathematical knowledge but also influenced how she felt about mathematics. She described how she learnt to be passionate about what she was doing and that she must do things from her heart. This passion was reflected in her discussions when she explained how much fun she experienced during tutor training sessions when tutors compete in teams to solve mathematical problems. She even compared learning mathematics to playing a game. It stood out how her learning experiences solving mathematical problems filtered through to her personal experiences, changing how she planned and analysed problems in her life. Her teaching experiences led to her decision to pursue teaching as a career. The way she described her personal experiences with the other tutors was worth highlighting: *"A cosy genuine loving and caring small family."*

4.2.4. Phuti

a)   Phuti's learning experiences

Learning own content enhancement

Phuti explained that the tutor programme taught him many ways to solve mathematical problems. He stated: "*For me being a tutor for more than three years, maths is not about having plan A only, because that is like digging a hole for yourself. Maths is about having plans A, B, C and if not D, why not E? Sometimes they may all work. Mathematicians finds the simplest and easiest way to solve problems.*" He believed that no matter in which grade you are, mathematics is simplified when breaking up a sum, visualising it, having multiple ways to solve it, and finding the answer. He described it: "*You have fun as you play with the numbers.*" He said that if he had this approach to mathematics in Grade 12, he "*could have killed maths, but not only maths. maybe other subjects like physics and life sciences.*" Phuti said he enjoyed it when tutors solved mathematical problems, competing in teams during training sessions to develop their own content knowledge: "*We learn while playing, unrecognisable, but it really does the trick.*" He described how symbols in mathematics (+, - and x) played specific roles in his mind. For him, it was only about using the correct format for these symbols, and he thought of each symbol as operating independently. He explained that he did not realise that all these operations could be used to find the answer for one division sum. Phuti realised the value of visual representations such as the cards and counters in mathematics: "*They are the best and most understandable ways to learn because you write what you see.*" He described the contrast between his experiences in school as a learner in large classes versus tutoring a small group: "*Tutoring in a one-to-one or in a small group is free from the chaotic classroom setting.*" He said that in his primary school grades, he was taught that subtracting a bigger number from a smaller one was impossible, but in the secondary grades, he was taught differently. He realised the importance of teaching the learners he was tutoring correctly in the early grades. The tutor programme changed Phuti's approach to mathematics: "*In school, we were taught that if you fail mathematics, you will be isolated and repeat your grade. The tutor programme changed this when we were taught to be patient and try to understand a person's background, to complement the little progress and learners' confidence will increase both at school and in life.*"

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Learning how to teach

Phuti explained: *"Being a tutor made me realise it is not only about dishing up lessons and giving out knowledge. I realised that I also need to understand the learners' attitudes daily because it does not stay the same but changes."* He claimed that he learnt to have patience and a positive attitude towards learners learning mathematics slowly: *"This programme taught me how to be patient. As tutors, we tend to struggle with the pace and the new things we teach the learners. I found that the learners are also frustrated engaging with new concepts. It teaches us to be slow and stay calm towards the learners' attitudes."* Phuti's view was that children's feelings and emotions were influenced by their household background, which influenced their class performance. He believed he could improve learners' attitudes from April to August 2022. His experience was that learners only participated and concentrated if the lesson was presented correctly, influencing how much work they could do. He also experienced that rewarding learners motivated them to improve their performance to progress faster through the work.

Phuti explained that watching tutors presenting their lessons to the other tutors during tutor training sessions was one way he learnt how to teach. From his point of view: *"I learn better by taking action … that is how I learn."* He felt that he learnt to deal with challenges during lessons through teamwork, solving problems with the team. Phuti described that when he taught a lesson, it helped him to be confident, understand what had to be taught and have different strategies to approach difficult sums. He emphasised: *"I learnt that I must have multiple plans to teach my lesson. So, if the learners do not understand plan A, then plan B comes in handy."* He added: *"Our programme director helped us a lot with strategising and planning when our lessons did not work out."*

Learning content to teach

Phuti explained that when learning the content of a lesson, it was important for him, as a tutor, to understand it. He claimed that the mathematics content they taught the learners was new to him: *"I did not know it when I was a kid."* For this reason, he wanted to share it with younger children; he felt it would help young children and make a big difference in mathematics teaching. When learning the content to teach, he realised that there are more straightforward and smarter methods that children can

utilise to improve their understanding of mathematics. He described how he learnt it; he read through lessons the day before teaching them and wrote examples on paper to ensure he understood them. If he had questions, he put them aside to ask during the tutor training session. If there were difficult lessons: *"That's where teamwork comes in, discussions and problem-solving."* His opinion about the lesson plans was: *"I can say that they are mind-blowing to me; they make things easier for me. The lesson plans are very straightforward. It gives you the pictures and the lesson content."*

b)   Phuti's teaching experiences

Teaching small groups

Phuti explained: *"As a tutor it's easier, simpler to give individual attention to each learner in a small group."* He believed small groups worked well because learners concentrated better in a small group; tutors could check on all the learners and understand their abilities. He enjoyed teaching small groups: *"It really motivated me to see our group's improvement. We had one of the slowest groups, but they showed great improvement. They managed to understand concepts that were initially difficult for them."*

Teaching the lesson content

Phuti explained that his teaching experiences were shaped by the feedback and responses of the kids he taught. He explained: *"I can have plans A, B, C and D to teach the children, but child 1, 2 and 3 may understand my plan A, but it may never work for child 4,5 and 6. This is why planning and sharing ideas before lessons are important, because what works for me might not work for you. So, I must diversify."* He believed that the lesson content was not enforcing methods but enabled the learners to improve their understanding of the classroom curriculum.

Teaching with other tutors

Phuti described other tutors: *"Pillars of strength … we got each other's back when the other one is down, we just lift him or her up. We all get along so well and support each other. I can say we are nice people."* Phuti has been participating in the tutor programme since 2020, and when he looked back at the past years, he thought tutors developed a strong bond over the years. He explained that although most of them

went to school together, they did not know each other. In the programme, they gained experience and got to know each other's strengths, which improved their teamwork: *"We were not used to each other, we were not prepared tutors as we are now, we were not experienced. [Now we know] where you are lacking, bring in him or her [another tutor] to fill the space. Always working together, teamwork."* He further explained: *"We always listen to each other's feedback after the lessons and compliment the winners in the daily challenges we do. We learn from each other's mistakes."* Phuti felt that everyone was part of the decisions taken in the programme. He said everyone contributed, but the final decision was the smartest, making a huge difference.

c)   Phuti's personal experiences

Job preparation

Phuti believed that the tutor programme prepared him for a job because he learnt to work under pressure during some tutor sessions: *"Time management and responsibilities. The programme helped me a lot to do tasks on time, arrive on time and prepare for what must be done. Taking responsibility for my actions during and after the lessons."* Phuti experienced discussing different approaches during and after the lessons and developed a greater mindset when working under pressure. It helped him think of different ways to get things done under pressure. He also felt that the programme taught him perseverance, patience and a willingness to learn.

Future career decisions

Phuti felt that the tutor programme influenced his thoughts about the future and the benefits of becoming a teacher one day. He explained: *"Although the tutor programme motivates me to be a teacher one day, I haven't decided on a career yet. However, I can certainly see that I want a qualification or education one day*." He said that if he taught one day, he would prefer to teach at a rural school. His reasons were: "*I grew up in a rural area and understand the struggles of living in rural areas. I have seen that learners need a lot of attention at rural schools."*

Social and emotional well-being

Phuti experienced the tutor programme as a positive environment that opened his mind. He described: *"The vibe is fantastic, every day is a joyful day. Despite sometimes*

not being a productive day, we cherish the little progress that has been discovered, and it feels awesome." He experienced that working with children could be tough but it could also be fun: *"Even though sometimes working with kids is not going to be fun there is something that we going to take home that is either inspiring or we learnt from it somehow."* Phuti described how other tutors support him emotionally: *"We are looking out for each other and motivating each other when we are demotivated."* He also claimed that the stipends made a difference and helped him to achieve his financial goals.

Adult development

Phuti's experiences as a tutor made him realise that he needed to consider people's emotions before giving inspiration and knowledge to them. He claimed that he learnt many things since he became involved in the tutor programme: *"I gained "massive" skills and knowledge I didn't have when I was a kid."* He said the programme taught him time management, requiring discipline and self-motivation. He learnt a lot about arriving early for the programme and managing the time through the sessions. This programme taught him to have multiple plans, even at home when he cooked, did house chores, or if something broke: *"I like multiple streams of opinions. I was not like that. I learnt it on this programme. It helped me to expand my knowledge every step of the way."* He explained: *"Throughout the three years' experience, the programme taught me patience and discipline and most powerfully, the 'willingness-to-learn' habit. This will also benefit the child that I have in future. I would love to use the skills I developed in the tutor programme to assist my community."*

Socialisation

Phuti's social experiences in the programme evolved around collaboration and cooperation. During his discussions, he emphasised teamwork a lot: "*Communication, teamwork and problem-solving are the most important aspects that I gained through this programme. Teamwork Ma'am is very important, that's what I learnt in this programme. It [the programme] teaches me every day. You cannot always be right. At some point you need some assistance. Teamwork for me it is important.*"

d)   Summary of Phuti's experiences

The following circle diagram captured the experiences that dominated Phuti's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing his essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.5

Summary of Phuti's learning, teaching and personal experiences
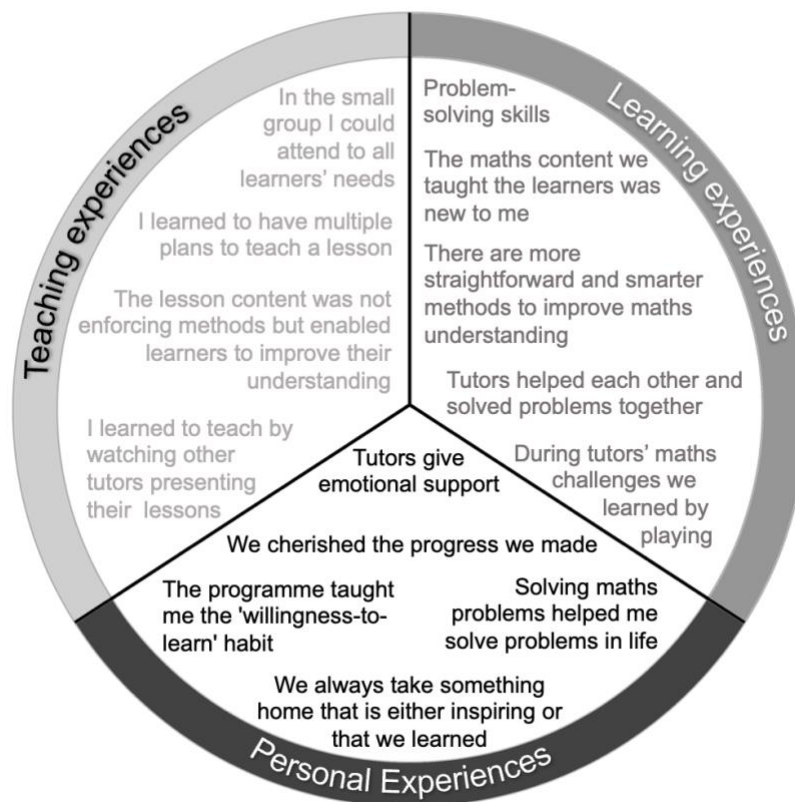
e)   Salient points in Phuti's experiences

Phuti's focus on the support he received from the other tutors in the programme was very prominent in all his answers. It was apparent that the other tutors played a significant role in his teaching experiences. He relied greatly on teamwork, other tutors' views, team problem-solving and emotional support. His personal experiences are dominated by many positive emotions about the programme, describing it as

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"fantastic, every day is a joyful day" and *"we cherish the little progress that has been discovered, and it feels awesome."* What stood out about his mathematical experiences was the programme's significant influence on his subject knowledge. He claimed that the mathematics content they taught the learners was new to him; realising that there were more straightforward and smarter methods to improve mathematics understanding. His eagerness and passion for learning were evident in his discussions, and he claimed he did not have a *"willingness-to-learn"* habit; the programme taught him this approach.

4.2.5. Ziyani

a)   Ziyani's learning experiences

<u>Learning own content enhancement</u>

Ziyani claimed that since he became involved in the tutor programme, he learnt new things about mathematics every year, things that he did not know, like: *"Using the counters and breaking down when subtracting. I learnt that I could solve multiplication and division in different ways."* Ziyani explained that in school, he thought subtraction could only be done by writing the numbers underneath each other and through 'borrowing'. He said the tutor programme changed this when he learnt to break the numbers down to do subtraction, which was easier for him. He said his understanding of multiplication improved when he learnt to use the area method to solve multiplication problems. He further explained that he thought the long division method was the only way to solve division problems, but he found it easier to use the 'big 7 approach', which improved his understanding of division. The introduction of visual representations for mathematics was also new to him. His description of his mathematical experiences was that he learnt that mathematical problems have many solutions. He also learnt to be a fast thinker, creative when solving mathematical problems or games, and to be good at doing mental mathematics. Ziyani always thought mathematics applied only to school-related matters, but he said: *"There is maths in everything you do. Real-life situations always involve mathematical problems."* He elaborated: *"If I had this knowledge when I was in Grade 12, it would have helped me a lot because I can see that there are many other ways to solve problems in maths that I did not know of before. When I was in Grades 9 or 11 or 12, I used to think that maths was hard. Now I can see that maths is not hard; it just needs more practice and time. I now know there*

is more than one way to solve a maths problem. When I was in Grade 12, they just taught us one way."-

Learning how to teach

Ziyani explained that the tutor programme taught him to be patient with the learners, especially those who were slow. He said he had to find a way to teach them according to their own understanding: *"The tutor programme taught me to adjust to a standard for learners to be free around me and understand what I teach."* He felt that he was successful in achieving this: *"Learners improved a lot, which made me happy and showed that we made progress."* He also described how some learners were difficult to manage, but he learnt how to successfully manage and work with difficult learners. He said: *"I learnt to be a leader and to interact with the learners. I learnt to adjust to the learners' learning pace."*

Learning content to teach

Ziyani claimed he did not know you could teach learners to break down multi-digit numbers to do multiplication and subtraction. He also learnt that you could use counters and place value cards to teach learners in Grades 4 and 5. He admitted: *"Using counters, [place value] cards, and base ten blocks are more helpful than just writing."* When learning the lesson content, Ziyani ensured he understood the lesson and how he would present it. He looked at the lesson the day before to prepare, but it helped him learn by discussing it: *"Because if we discussed it, there were some questions or things that I did not understand. While we are preparing the lesson during the tutor training session, I get to understand what I must do. Maybe if I encounter some problems, how will I deal with them."* He felt it helped a lot when one of the tutors showed the others how they would present their lessons: *"If maybe you call another tutor to present the lesson, I can sit down and see or learn where I am missing some points. I can learn from everyone because we are not thinking the same things about the lesson. Others have their own opinion that is different to mine that will help the learners."* His opinion about the lesson plans was that they were good because they showed tutors what they needed to do during learner intervention sessions. He said: *"What I like about it [the lesson plan] is the steps and the pictures. We struggled before we had the photos and pictures in the lessons."*

b)   Ziyani's teaching experiences

Teaching small groups

Ziyani said that in small groups, he could attend to learners individually. He felt it was easy to teach small groups; there was less noise, and learners cooperated in small groups.

Teaching the lesson content

Ziyani described his teaching experiences: "*We teach in order, step by step, in everything we teach.*" He also thought that learners understood the tutors' lesson content better than the content taught in class.

Teaching with other tutors

Ziyani explained that he saw the tutors as his brothers and sisters. He felt it was like a family and said: *"I have never seen tutors fighting amongst each other. It is like a family. You are our mother, and we are brothers and sisters."* He felt that tutors were there to help each other, and their relationships grew as they got to know each other better over the years. He felt that getting to know each other helped them to improve as tutors by working together as a group, attending to problems together by brainstorming ideas and finding solutions on how to deal with the learners as a group. He added: *"We are a winning team, after all."* He added that sometimes he felt the tutors did not take him seriously, but most of the time, when he discussed a point, I (the researcher) said it was positive and we must add it to the lesson.

c)   Ziyani's personal experiences

Job preparation

Ziyani felt that the tutor programme prepared him for a job, because it taught him to be punctual in everything he planned. He was convinced this would help him when he was called for an interview one day: *"When they say I should be there exactly at 9 o'clock and not a minute late."* He also felt that the programme taught him how to be a leader. He explained that he learnt to be committed to what he was doing by giving his best in what he had been assigned to do. He also learnt to take everything that he was doing seriously. He felt that it prepared him for the workplace because he learnt to work in a team, brainstorming ideas that would help the team move forward. He

experienced difficult times in the programme and, through this, learnt to be patient and open to learning new things. Ziyani claimed he gained confidence: *"It really helped us to install the feeling of being able to face people no matter how shy you are."*

Future career decisions

Ziyani believed that the tutor programme influenced his future and choice of career. He said the programme motivated him to become a qualified teacher one day because when he started working with the learners, he developed a love for them and became very patient with them. He said: *"It is so nice working with the learners. The respect and joy they contribute is so amazing."* He wanted to teach at a rural school because he believed rural schools were peaceful because there were few troublemakers. He also believed that learners in rural schools knew what they wanted (unlike other schools) and wanted to change their home situation and *"… see themselves living in nice places."*

Social and emotional well-being

Ziyani explained: *"Being with the learners boosts my mood and gives me strength."* He felt the programme had a very happy environment: *"I am happy to come to school, and I leave here happy."* He described how nice it is that the tutors shared ideas, played games and argued until they reached an agreement: *"We laugh together and have some nice times. It is nice and healthy, and the programme has a beautiful vibe with the tutors. The stipends that I receive from the tutor programme help me to do a lot of important things with the money."*

Adult development

Ziyani believed that the tutor programme positively influenced his development as an adult. He believed that the programme would help him influence his community because he could use the skills he developed to help learners in his community whenever they need help with mathematics. He said: *"Some learners [already] come to me to seek help with mathematics."* He helped his oldest sister's son with mathematics. He believed he would also help his own children one day. He explained that the tutor programme taught him to be patient with everything and that patience is the key to greater things in life. He learnt to be punctual, work with learners, and be a

"big brother" to the learners. He added: *"I learnt to take every task I have been given seriously, and I learnt to work hard and to be responsible in life."*

<u>Socialisation</u>

Ziyani felt he could socialise with the learners at home and said: *"The respect the learners give me is good."* He learnt that teamwork was the key to solving many things they faced because they could share their responsibilities. He said: *"Listening to one another's opinions helps us to grow and learn many things from each other."*

d)   Summary of Ziyani's experiences

The following circle diagram captured the experiences that dominated Phuti's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing his essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.6

Summary of Ziyani's learning, teaching and personal experiences
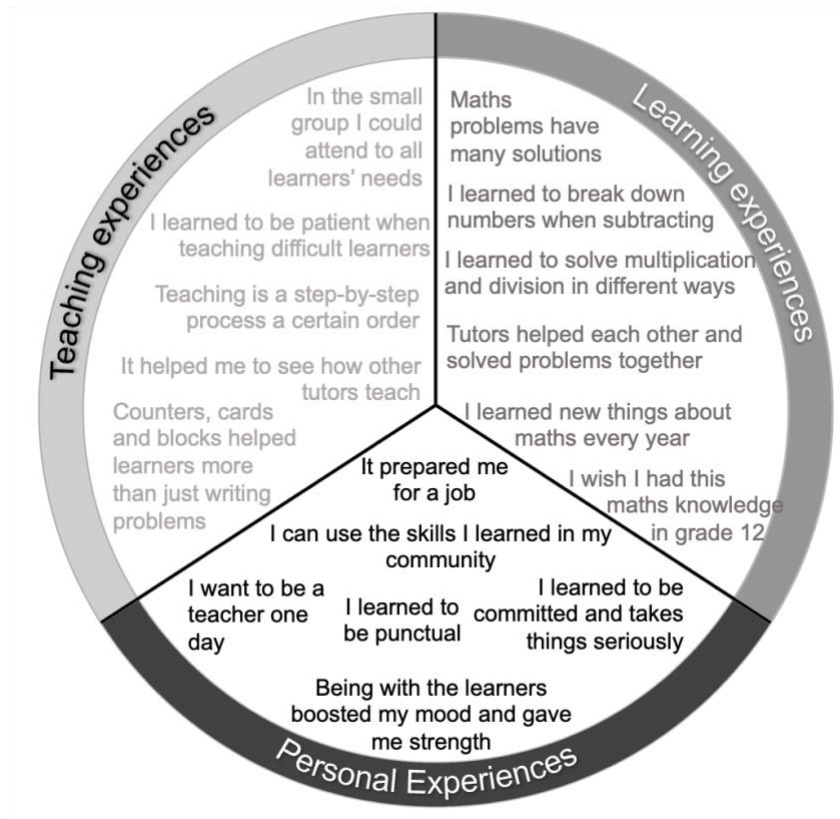
e)   Salient points in Ziyani's experiences

From Ziyani's descriptions of his learning experiences, it is evident that he was exposed to many new things in mathematics that significantly changed his mathematical content knowledge. As far as his teaching experiences were concerned, his answers indicated that he had to adapt a lot during his teaching journey to deal with learners with different abilities and emotions. During his testimony about his personal experiences, it stood out that his role as a tutor in the community built his self-esteem, and it was very important to him that the learners viewed him as a *"big brother",* and he felt they contributed *"respect and joy".* Other personal experiences that dominated his discussions were that he learnt to be punctual, disciplined and responsible by taking tasks seriously.

4.2.6. Jabula

a)   Jabula's learning experiences

Learning own content enhancement

Jabula explained that throughout her whole involvement in the programme, she felt that she learnt new things about mathematics every time she came to school. She described how her knowledge changed about multiplication, division and subtraction. She did not realise that multiplication was about groups and what was inside the groups. In school she was taught to subtract the 'smaller' number from the 'bigger' number, but in the programme she learned to subtract numbers by breaking them up into hundreds, tens and units. She also misunderstood the concept of 'borrowing' when doing subtraction: _"In school I thought when you borrow for the units from the tens, you borrow one, but [I realised] you borrow ten. The tutor programme changed it when we were using the base ten blocks."_ She thought that division was difficult, but the programme changed it when she learnt that division is sharing and how to use the big 7 approach to solve division problems. She explained that the visual representation used in the programme _"makes it easy to see very good"_ and that mathematics encouraged logical reasoning amongst the tutors. She said: _"I did not know I was capable of tutoring maths, and the programme also helped me to help my siblings with maths, which makes it easy for them now to use our strategies to pass maths at school."_ She described her mathematical experiences in the programme as good experiences and used them at home and in her daily life. She described how she used grouping to help her mom buy KFC for her sister's party. She claimed that Grade 12 would have been very different for her if she had the mathematical knowledge in Grade 12 that she learnt in the programme: _"If I learnt mathematics in this way when I was a child, it would have been so much easier."_ She also used to rely on a calculator: _"Now, I calculate it with my mind first to check the answer before I use the calculator."_

Learning how to teach

Jabula mentioned many things during her discussions that she learnt about teaching. She learnt to be happy, friendly and approachable, appreciated learners as individuals, engaged with struggling learners, challenged smarter learners, and treated learners the same way she wanted them to treat her. She believed in creating an environment where _"learners will be free to work with you."_ She believed this led to learners having

positive energy towards the lessons, helping her to work with them. She added: *"I learnt to explain concepts, and using their [the learners'] language, helps them to understand."* She believed that most learners improved due to treating them this way.

Learning content to teach

Jabula mentioned three things that were new to her when she learnt the lesson content for Grades 4 and 5, and that was: *"I did not know equal exchange, the area method the way we are doing it now and multiplication as the number of groups and what's inside the groups."* She felt that the tutor team helped her to understand her lessons during tutor training sessions: *"My team's opinions make me think thoroughly about the lesson. If I feel uncertain, I will ask my team, and they will help."* She explained this happened when tutors presented their lessons during tutor training sessions: *"Sometimes I will say that I went through the lesson and I understand it and this is how I am going to present it to the kids. When someone else explains it to me, I will get points where I made slight mistakes, and then I realised what I should do to make it simple for the learners."* When asked what her opinion was about the lesson plans: *"I love how the lesson plans are now compared to how they were before because now we get to see and understand them better. The lesson plans are more perfect because you know what to teach during the following day's lesson. I love the structure and the writing because when we teach, we don't read it step by step, but it guides us on what to do."*

b)   Jabula's teaching experiences

Teaching small groups

Jabula felt it was good working with small groups because she could see if learners enjoyed or understood the lessons and how they felt about the lessons. She explained that she could easily identify learners who did not understand and could help them.

Teaching the lesson content

Jabula believed learners progressed well because of the lesson's counters and place value cards. She also mentioned that the lessons solving real-life problems helped the learners.

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Teaching with other tutors

Jabula stated: *"Without teamwork, we cannot do this."* She further explained: *"The tutors mean a lot to me and they turned into my second family. Without them, this programme was not going to be perfect. I think it's our positive thoughts about each other and that we treat each other equally. We never look down on someone. We don't focus too much on a person's life. When we are here, we are all equal."* She believed everyone came to school, knew what to expect and left their problems at home. She felt that the team helped her to deal with challenges, not bringing her life problems to work. She said: *"We are giving each other the same energy we receive. When you get to school, you know you will work."* She considered her lessons as sometimes part of the programme's decision-making, but not always.

c)   Jabula's personal experiences

Job preparation

Jabula believed that the tutor programme prepared her for a job because she learnt how important time management was in this programme. She claimed that the programme helped her to work with people, be responsible and work hard. It boosted her self-esteem. She felt that her communication skills improved, and she became a better listener. She explained: "*Our Communication skills improved compared to when we started this programme. It changed our stage fright. If you are shy, you cannot face people you cannot raise your opinion".* Jabula emphasised: *"Solving problems was one of the best things the programme thought us."*

Future career decisions

Jabula agreed that the tutor programme influenced her future career choice: *"I would never have known that I love teaching so much if I was not involved in the tutor programme. It got me not only to want to study teaching but teaching maths. When I finished school, I never thought I could work with kids. Ever since I started tutoring, I have enjoyed every single session. Now I can see that I can teach, which is a goal I want to achieve."* Jabula said she would teach in a rural school one day because a rural school needed someone like her to teach and give the learners emotional and physical support.

Social and emotional well-being

When asking Jabula whether the programme contributed to her social and emotional well-being, she explained: *"If I come to work sad or not feeling well, everything feels okay when I sit down with my team and my mood changes. The kids and my team are mood changers because you can never be sad around them."* She described how much the love and support the tutors gave each other meant to her. She added that she experienced the tutor programme as a positive working environment: *"We are happy in this programme because of the love we have for each other. It is getting better each and every year."* She talked about the emotional support tutors provided: *"We know when this one is like this, something might be wrong. We know the face and the smile. Then if I you are not okay today, let me not step on the toes."* As far as the stipends' contribution was concerned, she said that although her stipends were not a lot, they contributed and helped.

Adult development

Jabula felt that the tutor programme positively influenced her development as an adult. She said it developed her communication skills to work well with the kids. She also expressed her wish to use these skills to help other people. She also believed the programme would help her with her own kids one day. She was already tutoring her siblings and cousin at other schools, and they were doing very well.

Socialisation

Jabula believed in the tutor team: *"Teamwork, love, care and respect we have for each other worked so well in the tutor programme."* She explained that she learnt to respect others and listen to their opinions. She described: *"In the tutor programme, we share skills, knowledge, experience, good vibes and positive energy every day. The vibe is always good and positive. I don't remember anyone coming to work and giving me a negative vibe."*

d) Summary of Jabula's experiences

The following circle diagram captured the experiences that dominated Jabula's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences,

teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.7

Summary of Jabula's learning, teaching and personal experiences
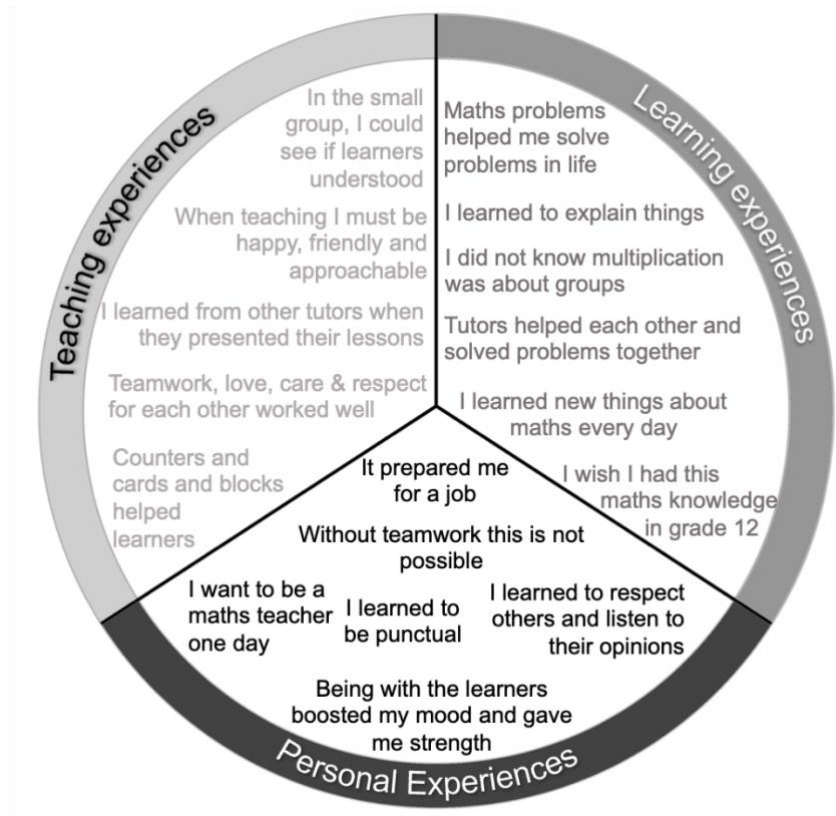
e)   Salient points in Jabula's experiences

Analysing Jabula's discussions of all her experiences, it is evident that they were filled with positive emotions of joy and love about the programme and her teammates. Her learning experiences reflected a good combination of acquiring new mathematical knowledge and teaching skills. Her mathematical experiences filtered through her personal life, and she dealt with life problems using the mathematical skills she learnt in the programme. The contrast between her thoughts about her future career when she left school in 2016 and how she felt in 2023 stood out. When she left school, she never thought that she wanted to work with children, to the point that she developed a

love for both mathematics and teaching in the programme and wanted to pursue a career in teaching. Discussions about her personal experiences evolved a lot around the other tutors' roles in her experiences and their importance to her, such as the value of teamwork, understanding and accommodating her teammates, relying on, and supporting them, and that their love was her source of happiness in the programme.

4.2.7. Mnguni

a) *Mnguni*'s learning experiences

Learning own content enhancement

Mnguni explained that learning mathematics in the tutor programme taught her reasoning skills. She said: *"I learnt that you must explain why you agree or disagree."* She added that the programme also taught her problem-solving skills and to apply mathematics to many things. She described how her knowledge changed about multiplication, division and subtraction. She never knew that counters could be used to represent multiplication problems (concrete), and visualising it improved her understanding. She added: *"In school, I thought that when multiplying, we cannot swap the numbers around that we are multiplying with each other. The tutor programme changed it when we were using the counters because it taught me that I could swap the numbers around, but the drawing or representation will not be the same. The counters made things simple".* She learnt that multiplication was about groups and what was inside them and that it was easy to solve multiplication problems by breaking up the numbers. The programme also taught her the difference between grouping and sharing when solving division problems. She said she learnt to solve division problems in other ways than using the long division method. She further learnt to focus on reading for understanding. She was convinced: *"If I had the mathematical knowledge in Grade 12 that I learnt in the programme, things would have been different. Maths would have been easier for me in Grade 12 if I understood other ways to do things, even though we are working with Grades 4 and 5 now, there are some of the things we are learning in the programme, that I could have used and applied in Grade 12."*

Learning how to teach

Mnguni mentioned many things during her discussions that she learnt about teaching. She learnt to adjust to the learners' pace and be open to her learners so that learning

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can be easy for them. She felt that it was important to teach learners multiple ways to solve a mathematical problem so that they could choose the one they understood best. She was satisfied when learners showed understanding: *"The satisfaction I get when teaching the learners, they tell me that they understand after I showed them something or the other way to get the answer."* She felt that she also learnt to help struggling learners and gained a lot of experience in helping learners to improve and make progress. She explained that, based on her experiences, this meant learning how to deal with learners as individuals by getting to know learners very well. She felt that knowing her learners enabled her to create a productive working environment. She also explained that she discovered how learners could gain knowledge from each other. When asked how she dealt with challenges when she taught, she said she learnt over time, trying many different things to overcome challenges.

Learning content to teach

Mnguni explained that although she learnt the lesson content by reading the lessons the day before learner sessions, the tutor training made it easy for her to learn the lesson because: "*When discussing it with the whole group, that makes it easy for me to teach the lesson, because I gain something that I did not know before.*" She said that when a tutor presented a lesson to the group, it made a difference because different options were discussed during group sessions: "*When we talk about something and discuss how we are going to do something and what will help the learners."* In this way, she felt she knew exactly what she would be teaching and did not encounter problems: *"I felt prepared if I had different ways to present the lesson."* When asked what she liked about the lesson plans: *"They must be kept the way they are because they are visible and understandable. I like the steps and the photos. The photos make it easy and very visual."*

b)   Mnguni's teaching experiences

Teaching small groups

Mnguni experienced that in small groups, it was easy for the tutors to see which learners understood the lessons, and they could attend to learners individually if they did not understand. She believed that grouping learners according to their marks or performances worked well. However, if a slower group was (physically) next to (or

close to) a faster group in a class or the hall, the faster group disrupted the slower group because they were doing different lessons. She recalled suggesting we change this by putting groups next to each other, or close to each other in the class or the hall, doing the same lessons on a specific day, which worked well.

Teaching the lesson content

Mnguni felt *"mastering the lesson content"* was the key to presenting her lessons with ease. She experienced the importance of considering learners' abilities and accommodating all the learners. She realised that she should not be emotional about it and repeated the lesson content or explained it in a different way when learners did not understand: *"Some learners understand fast, and some you have to repeat what you said, explain again. Others need different strategies to be used before they understand. Be factual so that you won't panic when you teach."* She believed their lessons improved learners' understanding because they were teaching them simpler ways to solve mathematical problems. She also claimed that teaching the learners multiple ways to find a sum's answer helped them because they were not limiting the learners. She also thought that using counters to teach learners how to count worked very well and that most learners' marks improved.

Teaching with other tutors

Mnguni's experiences teaching with other tutors: *"The tutors mean a lot to me; they are so special to me, they are like my siblings. I think it developed over time. It makes me feel good, open and free. It boosts my self-esteem."* She felt that the vibe amongst the tutors was exciting, and there was jubilation in the programme. When asked why: *"It is the connection, the way we treat each other. It wasn't always like that. It changed because we are growing up and learning different things as time goes by. In the beginning, it was very difficult. We were not used to each other, and everything was fresh. We did know each other; we did not know what to expect and things were uncertain. This year has been really very nice."*

c)   Mnguni's personal experiences

Job preparation

Mnguni believed that the tutor programme prepared her for a job because she gained skills to help her in another job. She said: "*The tutor programme taught me to be committed to my work, dedicated, punctual and respect others.*" She also claimed that the programme taught her to communicate with people and to understand other people's thoughts and feelings in a situation from their point of view rather than her own: *"The programme taught me empathy."* She added that it taught her to come up with various solutions when facing a problem, which would help her to overcome problems in her job one day.

Future career decisions

Mnguni claimed that the tutor programme influenced her career choice: *"I want to be a teacher one day, and I won't give up. I would teach at a rural school because you can learn many things. You can plant trees or vegetables and sell them to buy the school's necessities."*

Social and emotional well-being

Mnguni claimed that tutoring increased her self-esteem and boosted her confidence. She also felt the programme made her happy because she learnt so many things, and learning made her happy: *"I gained from the programme because I learnt new things I did not know. My reading skills improved and my communication skills."*

Adult development

Mnguni believed that the tutor programme positively influenced her development as an adult. She discussed how she developed many skills and wanted to use these skills to make a difference in her community: *"I will make my community a better community because I will communicate with community members and find solutions to solve problems in my community."* She claimed that the programme influenced her approach to parenting in the future: *"If I am a parent one day, the programme will influence me in a good way. I will get a chance to teach my kids easy ways to solve problems. It will be easy for me to break big problems into small problems."*

Mnguni believed that due to her participation in the programme, she can *"associate [connect] with other people."* She learnt that if she worked with other people she had to be kind and friendly so that she could easily work with them: *"I enjoy communicating with my teammates about something that is about the development of the programme."*

d)   Summary of Mnguni's experiences

The following circle diagram captured the experiences that dominated Mnguni's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.8

Summary of Mnguni's learning, teaching and personal experiences
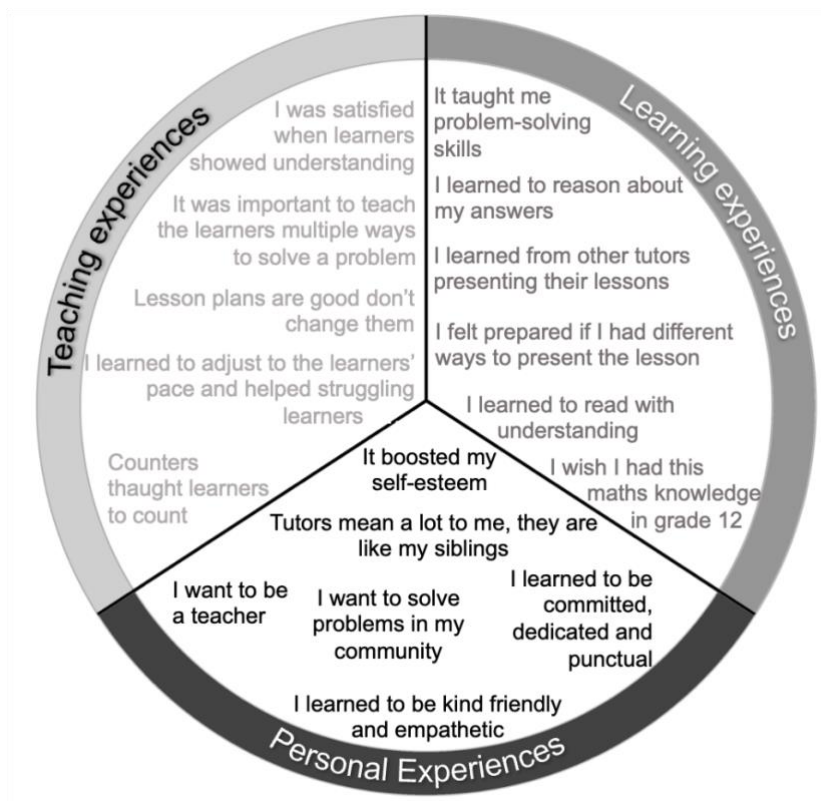
e)   Salient points in Mnguni's experiences

Mnguni's learning experiences centred around learning multiple ways to solve a problem, reasoning about her answers and having different plans. She wanted to use these skills to solve problems in her community, focusing on the people around her. Her teaching experiences had a substantial impact on her self-esteem. It was evident that tutoring was very satisfying to her because she could teach learners, they understood, and they could make progress. Her personal development evolved around discipline and relationships. She became focused on wanting to teach one day, being committed, dedicated to her work, and punctual. Her focus on people was prominent when she talked about the interpersonal skills she developed and how she respected others and learnt to be kind, friendly and empathetic.

4.2.8. Sally

a)   Sally's learning experiences

Learning own content enhancement

Sally said that her mathematical knowledge improved every time she came to school. She admitted that in the past, she depended on a calculator to do sums, but since she joined the programme, she realised how easy it is to break numbers into hundreds, tens and units to calculate an answer. She explained: _"You must first break a sum into pieces to make it simple, and then you put it together at the end—even the grouping method [works like this]."_ She also thought that division was independent of other operations, but the programme taught her: _"Where there is division, multiplication is also present."_ She explained that she only learnt how to do long division in school, but the programme taught her the big 7 approach: _"You will never go wrong as long as you know how to multiply, add and subtract.".._ She described how she only used one method to solve mathematical problems, but the programme taught her that she had to consider at least two or three other methods to know which one she understood the best. She realised that before participating in the programme, she solved mathematical problems by only writing the number symbols. She added that knowing the steps to solving a problem, _"is like a waste of time because the moment you forget one step everything is going to be wrong."_ However, the programme taught her that she could also use pictures or real-life examples to solve problems, which made things much easier.

Learning how to teach

Sally felt she gained teaching skills every time she came to school. She claimed every lesson taught her something new about working with the learners. She also learnt to teach during tutor training sessions when she presented her lesson. She stated: *"When I teach, I also feel I learn because the learners will ask: Why can't you do it like this? And then I will learn from that."* She acknowledged that it was important to accommodate learners with different abilities: *"I learnt because all the learners do not understand the lesson at the same time. Some are left behind, and at the end of the day, I must be able to help them understand."* She felt she had to ensure her learners understood the lesson before the end. She realised that coming to class and facing the learners required a clear mind and friendly approach: *"I learnt that shouting at the learners won't make them understand what I am teaching; learners will be afraid of me and lose focus."* Her experience taught her to create an environment to encourage learners to ask questions by focusing on how she communicated: *"I learnt to communicate with the learners so that they can be free around me."*

Learning content to teach

Sally explained that she learnt the teaching content by familiarising herself with it the day before they tutored. On the tutor training day, when tutors shared different opinions on approaching the lesson, she understood it better. She also felt that when they were doing difficult lessons or lessons that could be confusing, I (the researcher) explained it to them and pointed out what needed attention. She added: *"It works for me to go through the lesson twice—the day before and the following day when you explain to us during tutor training. So, for me, it feels that we are prepared."* She pointed out that she also learnt about the teaching content in the reflective sessions when tutors gave feedback about their lessons after they presented it: *"Afterwards when we give the feedback, you ask us what you have done and what you have achieved. The feedback session also helps to be more prepared."* Her opinion about the lesson plans was: *"The lesson plans to me are good, I like the photos; they explain things much more easier, because normally you would put a photo and then you write about the same thing; [if it was just writing] you have to imagine things, but now you are putting photos so you can see what you are writing about."*

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b) Sally's teaching experiences

Teaching small groups

Sally felt it worked well to group learners according to their understanding of lessons, so the learners who did not understand a lesson the first time could be grouped together, and tutors could repeat it.

Teaching the lesson content

Sally's teaching experiences showed her that it worked well; teaching learners to solve mathematical problems in different ways. She felt that if learners did not understand a certain lesson or approach to solving a problem and you taught them another, it allowed them to choose what they understood best: *"I like the way we are solving problems to teach the learners.* She thought that it worked well teaching division using groups: *"I did not know that you can teach it in this way. I am only familiar with long division."*

Teaching with other tutors

Sally felt that other tutors are like siblings to her: *"We are one big happy family. As siblings, one is sometimes not fine, and then the other one will lift the spirit. To me, we are here for each other."* She explained how the tutors gave her emotional support: *"Even when I come to school with a sad face, my brothers and sisters will lift up my spirit."* She added that their respect for each other and their ability to listen to each other's advice improved their teaching skills. She felt part of the decision-making in the team because everyone was allowed to share what was on their minds. She added: *"Two minds work better than one because everyone brings solutions to solving a problem."*

c) Sally's personal experiences

Job preparation

Sally felt that the tutor programme prepared her for a job. She claimed that presenting the lessons gave her the confidence to stand in front of people. She explained that the programme taught her to work independently and in a team. She added that she learnt to leave her personal problems at home when coming to work: *"Put everything that is*

happening in your life on hold, after knocking off that when you'll carry on with your normal life."

Future career decisions

Sally claimed that the tutor programme influenced her choice of a career. Growing up, she thought she did not want to become a teacher. This changed: *"Now I am falling in love with what I am doing. Teaching is like my baby to me. I believe I will teach one day. I wouldn't mind teaching at a rural school or anywhere else as long as I enjoy it."*

Social and emotional well-being

Sally experienced peace and enjoyment as part of the programme: *"Working with the kids helps me forget things because I focus on the learners, the laughter and sharing of jokes between lessons. It changes my whole mood. If I am feeling down, I know I will leave class in a happy mood. Working with children is a blessing."* She added that it made her happy, getting to know the other tutors by playing games and getting rewards. She explained that her learners' progress also influenced her emotionally: *"There is nothing happier than seeing your learners passing the subject you're tutoring. Part of the happiness is seeing how the learners are changing. If your learners are not improving, you will ask yourself: Am I doing the right thing? Do I know how to teach them? Am I not good at explaining to them? But when they are passing, you know that there is something that you are doing right."*

Adult development

The tutor programme positively influenced her development as an adult. She admitted that she did not know she had teaching skills, but she experienced that when she explained something to the learners and they understood it. She stopped comparing her thinking as an adult to that of the learners. This made her realise she could work with learners at their pace and without rushing them. She said the programme would also influence her parenting one day: *"When I am a parent, my children must know that they must practise maths daily. And if they are doing one sum, they must make sure that they are doing it in different ways. Three methods, because that is what I have learnt here. Then, from there they will pick the one they understand."*

Socialisation

Sally claimed the programme taught her communication skills and that she believed: *"Communication skills are needed everywhere to move forward in life."* She expressed her view about teamwork: *"Teamwork is part of Ubuntu. You can only sometimes figure things out independently, and sometimes teamwork is needed."* She said that when tutors felt hurt, they should share it with each other so that the person could apologise and not hold grudges. She learnt that, above all, the tutors must respect each other.

d)   Summary of Sally's experiences

The following circle diagram captured the experiences that dominated Sally's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

Figure 4.9

Summary of Sally's learning, teaching and personal experiences

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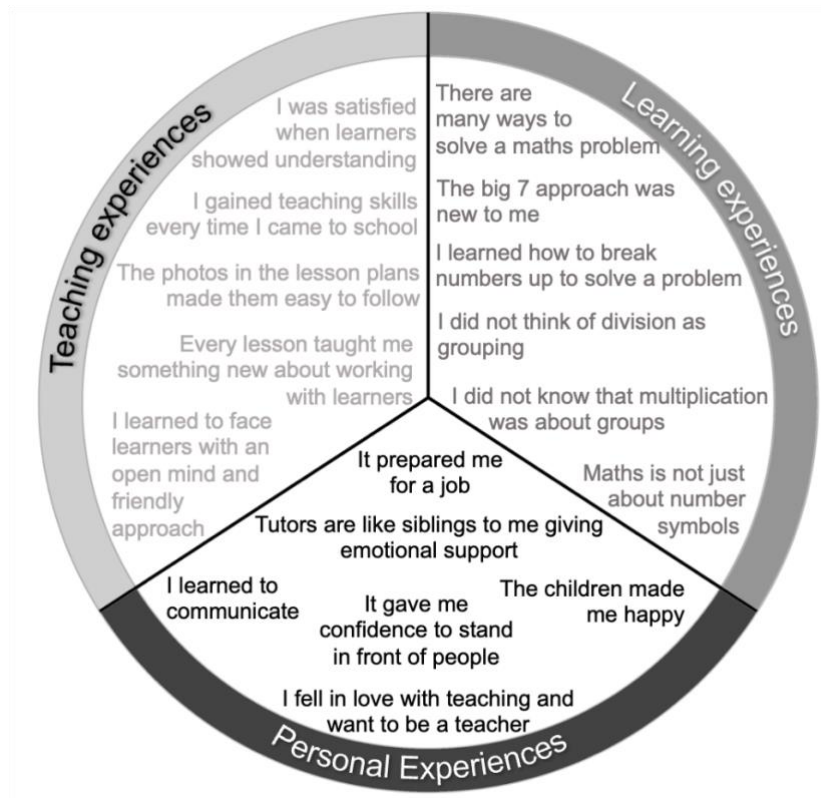
e)   Salient points in Sally's experiences

In discussions with Sally, it was evident how her mathematics content knowledge developed in the tutor programme. She gained new knowledge about multiplication, division and approaches to solving mathematical problems. What stood out about her teaching experiences was that she felt she learnt new things about teaching every time she tutored. It is evident how important it was for her to ensure her learners understood when she explained something and how much satisfaction she had when learners showed understanding. Her awareness of learning is prominent: *"When I teach, I also feel I learn."* Sally's personal development made an impression when she said she fell in love with teaching during the tutor programme. Growing up, she did not want to become a teacher when she thought she did not have teaching skills, but now (during the time of the interview), she believed she would teach one day.

4.2.9. Mandy

a)   Mandy's learning experiences

Learning own content enhancement

Mandy realised that although she was a tutor, she also saw herself as a learner: *"I am also a learner. I learnt things through our assignments and lessons I did not know before."* She said she was learning every day in the programme. She felt that tutoring helped to strengthen her understanding of mathematics. She said that mathematics taught her to think logically, identify and state the problem clearly, plan how to solve it and then apply the appropriate methods. She explained: *"There are simple and short methods to solve your maths problems. The tutor programme comes with a new method that is very easy and short for solving maths problems. I gained more knowledge of ways to solve problems quickly."* At school, she thought she could only use the traditional multiplication method. The tutor programme changed this when she learnt she could break up the numbers and use the area method. Her understanding of addition and subtraction changed when she used the base ten blocks and place value cards: *"I learnt addition using the base ten blocks and place value cards, and watching a video. It improved my understanding of addition, seeing that there are other easier ways than the one I knew. There's no need to carry the numbers to other numbers. I also learnt subtraction using base ten blocks and place value cards, which led to a different strategy of writing subtraction."* She explained that in the tutor

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programme she realised that mathematics is not just about numbers but that it represented real-life examples, which made it easier to understand mathematics. She felt the tutors learnt a lot from the jellybean challenges in the programme. She said: *"It is fun in the tutor programme, because we play games and at the same time we learn from those games because they are mathematical."* She thought it worked well that the challenge winners explained the questions to the other tutors who did not understand so that they could learn: *"So, it is fun. It's sometimes difficult, but it is always fun."* She believed that if she had this knowledge in Grade 12, it would have helped her. She realised: *"We are giving the learners a strong foundation for Grade 12. It is even giving us a strong foundation. We are sad that we did not have tutors in Grades 4 and 5. I can imagine if I had this chance to have tutors, I would have been far."*

Learning how to teach

Mandy claimed that the programme taught her that 'practise makes perfect' because most of the learners struggled at the beginning of the year, but as the year progressed, they improved significantly. She also learnt that when teaching, one could repeat the same lesson content to help learners, but they might still not understand, and it was very sad. She also believed it was important to maintain a positive attitude about mathematics to support the learners. In this way, she learnt how to handle learners' behaviour and how learners understood things. For her, it was important to consider learners' prior knowledge: *"Before continuing with the lesson, activate their minds to see if they didn't forget what you have taught them."* She referred to the tutor team's motto: *"As our motto says, we are creating change by teaching different ways to how the learners learn in the class; we find easier ways for them [the learners] to understand."*

Learning content to teach

Mandy explained that receiving the lesson the day before helped her because: *"Sometimes you will find that there are some of the things in the lesson that you, as a tutor, don't understand, and then when we go for tutor training you can ask and get clarification on things."* She claimed that she always felt prepared because there was enough time for her to prepare and address uncertainties: *"I come prepared, even if the learners ask me questions, I am able to give the answers because I understood*

everything." Her view was that the lesson plans were easy to follow: *"The photos helped because we as tutors, are also different, some of us are visual learners, so we must see something to understand more. It helps a lot."*

b) Mandy's teaching experiences

Teaching small groups

Mandy experienced that teaching small groups was probably the best space for learners to learn. She believed they have the space to think about new ideas, and how they want to respond to them. She said: *"I must give them time and space to develop and formulate their responses. Be non-judgmental. Be inclusive and bring every learner of the group in on discussions."*

Teaching the lesson content

Mandy's experiences teaching the lesson was that some learners understood quickly, and for some, she had to repeat what she said or use different strategies to explain the same thing. She thought using pictures in the lessons worked well because *"some of the learners understand more when they see the pictures."* She felt the programme made learning easy by giving learners examples that could be visualised. She also thought using real-life examples to teach the learners made it easier for learners to understand mathematics.

Teaching with other tutors

Mandy viewed the other tutors as her siblings: *"There is a connection between all of us. It is something that grows. If we don't get along, it will be hard to change the learners, so we must unite and be one. As time went on, we became closer."* She felt she learnt from the other tutors and that they needed to get along to explain things to each other. She also believed they supported each other emotionally: *"Most of the time, when the one is down, the others lift them up."* Mandy commented about the discipline in the tutor group: *"The discipline in the tutor group is very strict, but if there were no discipline, there would be no change."*

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c)   Mandy's personal experiences

Job preparation

Mandy believed that the tutor programme prepared her for a job one day. She explained that it improved her communication skills, which she could use to connect with others: "*In the workplace, communication skills help you collaborate with team members, share information and solve problems efficiently.*" She claimed that the programme taught her to be punctual, preparing her for the workplace, because *"being punctual helps you establish your reputation as a dependable and consistent worker"*. She also added that the programme boosted her self-confidence, which would help her as an employee to take risks and evaluate areas of improvement in the workplace one day.

Future career decisions

Mandy indicated that although she wanted to study teaching, she was also considering nursing. She applied for teaching and nursing at Nelson Mandela University and the University of Limpopo. She stated: *"I developed a love for nursing, but I still love teaching."* She believed that mathematics is the most difficult subject to understand, and the tutor programme developed her skills to help a child to understand it. She felt she could use the skills she developed in the tutor programme to teach one day. She said she would prefer to teach at a rural school because "*children from disadvantaged communities lack things to help them succeed. The shortage of teachers at rural schools affects learners' performance because there needs to be someone to teach them. I am one of those people that want to see people who have nothing changing into something.*"

Social and emotional well-being

Mandy felt that the programme made her happy because she gained a lot of experience on the programme. She experienced it as fun to be part of the tutor programme, because of the games they played while learning simultaneously. She said: *"It is fun and at the same time we learn from those games because they are mathematical."* She believed the programme helped her to forget about problems at home. She likes the vibe: *"It is a good vibe; we learn while we teach. The vibe is good because we are getting along; if we were not getting along, the vibe would not be good."* She experienced that the programme had a positive influence on her emotional

well-being because it boosted her confidence. The learners also affected her emotions: *"I know that when I am down, my mood will change when I get to class with the learners*." She felt part of decision making in the programme: *"I feel that something I say can make a difference because we have different ideas. If I have simpler ways to explain things, I can influence this."* Mandy referred to the tutor group's motto: *"Our motto says we are creating change. Our motto drives us. When you show us the graphs of the learners' marks, we can see that we are creating change and that there is improvement."*

Adult development

Mandy claimed that the programme developed her skills and capability to lead and share her knowledge with a group of learners. This showed her that she could help other people with her knowledge, which could help them to change their lives. She believed the tutor programme taught her problem-solving skills: *"I am able to come up with my own ideas."* She admitted that she was not always on time, but the programme taught her time management skills. She said the programme would influence how she would deal with her children one day: *"I already have experience in maths about what they [Grades 4 and 5 learners] are learning, so I would be able to use many ways to make my child understand. I will take part."*

Socialisation

Mandy felt the tutor programme improved her socialising skills because it helped her to socialise with different people and to be *"brave enough"* to share her thoughts and ideas. She believed that without communication, you cannot work with other people.

d)   Summary of Mandy's experiences

The following circle diagram captured the experiences that dominated Mandy's experiences in the tutor programme. It is divided into three sections, each representing the three main constructs of my conceptual framework, i.e., learning experiences, teaching experiences and personal experiences. Five to ten keywords or phrases describing her essential experiences were selected to inform each main construct. For this diagram, I only focused on the main constructs of the conceptual framework, not reflecting the sub-constructs (within each main construct).

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Figure 4.10

Summary of Mandy's learning, teaching and personal experiences
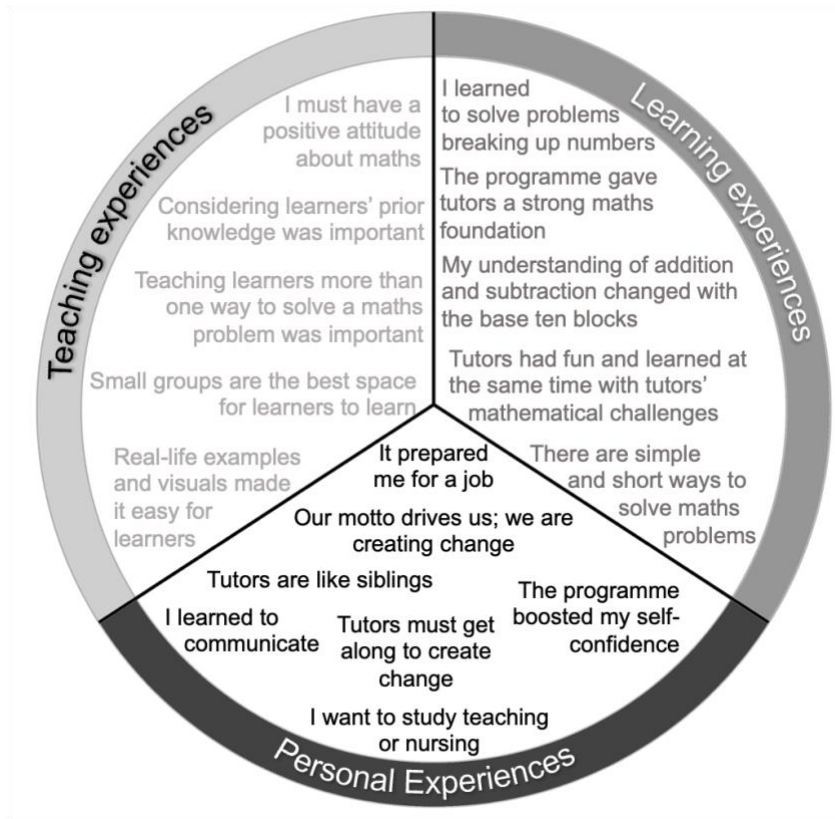
e)   Salient points in Mandy's experiences

The programme significantly strengthened Mandy's understanding of mathematics as part of her learning experiences, to the extent that she claimed it influenced her foundation of mathematics, changing her understanding of division, multiplication, addition and subtraction. It was a turning point when she realised that mathematics is not just about writing numbers but understanding what you are doing. When she described her teaching experiences, she mentioned the team's motto a few times: 'creating change'. She truly believed that the tutors were creating change in the way they were teaching. As far as her personal development is concerned, she wanted to study either teaching or nursing. Evidently, the programme boosted her emotionally; she said she could forget about her problems when she was at school, and the learners always lifted her mood.

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4.3. Summary of findings

In this section, I present the findings according to the three main constructs of the conceptual framework: 1) tutors' learning experiences, 2) tutors' teaching experiences, and 3) tutors' personal experiences. I start in section 4.3.1 by discussing the findings for tutors' learning experiences, consisting of sub-constructs 1-3, to answer the first sub-research question (see *Figure 4.11).* Then, in section 4.3.2, I discuss the findings for tutors' teaching experiences, consisting of sub-constructs 4-6, to answer the second sub-research question (see *Figure 4.12*). Lastly, in section 4.3.3, I discuss the findings for tutors' personal experiences, consisting of sub-constructs 7-11, to answer the third sub-question (see *Figure 4.13).* In the last section (section 4.3.4), I discuss the findings for all the sub-constructs (1-11) to answer sub-question 4. In this way, I answer the main research question.

4.3.1. Tutors' learning experiences

The first sub-question was:

> *How did tutors experience the learning aspects in the intervention model regarding learning mathematics content enhancement, learning how to teach and learning the content to teach?*

The following diagram is an extract of the tutors' learning experiences of the conceptual framework (sub-constructs 1-3) illustrating the part of the framework that applies to sub-question 1.

Figure 4.11

Extract from the conceptual framework of the tutors' learning experiences

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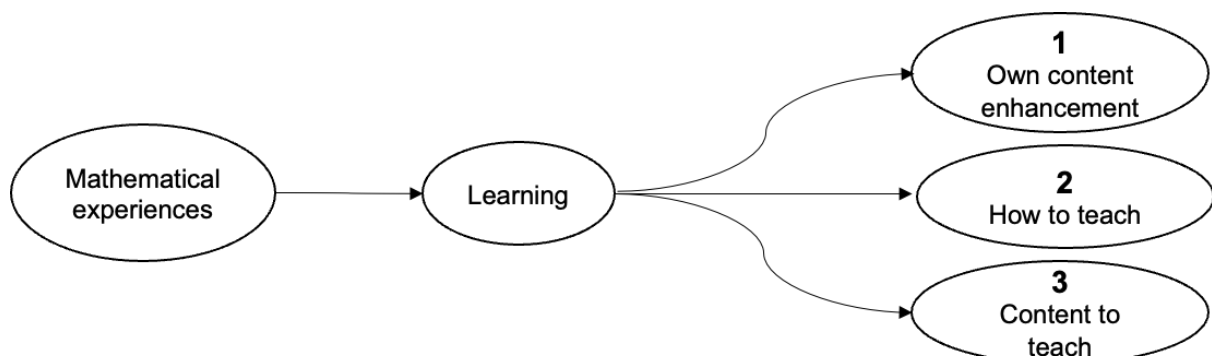
Learning own content enhancement

The analysis of the tutors' responses to their learning experiences of their own mathematical content enhancement revealed twelve main themes. These themes are shown in *Table 4.1*.

Table 4.1

Main themes of tutors' experiences learning mathematical content enhancement

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Learning Experiences										
	Own Content										
1	The programme improved my mathematical knowledge	√	√	√	√	√	√	√	√	√	**9**
2	I learned problem-solving skills	√	√	√	√	√	√	√	√	√	**9**
3	Using visual manipulatives to learn mathematics was new to me and helped me to visualise problems	√	√		√	√	√	√	√	√	**8**
4	The programme changed my understanding of division	√	√		√	√	√	√	√		**7**
5	The programme changed my understanding of subtraction	√		√	√	√	√	√		√	**7**
6	I realised mathematics is not just about using textbooks, writing number symbols and doing the steps correctly	√	√	√	√	√			√	√	**7**
7	I learned that mathematical problems represent real-life examples. It helped me to solve problems in my own life	√				√	√	√	√	√	**6**
8	I learned that mathematical problems have many solutions and learned to solve problems in different ways than before	√		√	√	√			√		**5**
9	The programme changed my understanding of multiplication	√				√	√	√	√		**5**
10	I learned to reason logically	√					√	√		√	**4**
11	I learned to break up numbers when solving mathematical problems				√	√			√	√	**4**
12	I wish I had this knowledge in grade 12				√	√	√	√			**4**

All the tutors experienced that the programme improved their mathematical knowledge and taught them problem-solving skills. They experienced that the programme improved their problem-solving skills in their personal lives. Most tutors indicated that visual manipulatives were new to them and helped them visualise and solve problems. More than half of the tutors' understanding of division, subtraction and multiplication changed. Most tutors did not realise that mathematical problems can be represented as real-life examples. They reflected on how this helped them solve problems, in contrast to their experiences in school when they thought mathematics was about textbooks, writing number symbols and following steps to solve mathematical

problems. The idea of learning many solutions that can be used to solve the same mathematical problems was new to most of the tutors. Four tutors experienced that the programme taught them to reason logically and solve mathematical problems by breaking up numbers. Four tutors wished they had the knowledge they gained in the programme in Grade 12.

Learning how to teach

The analysis of the tutors' responses to their experiences of learning how to teach revealed five main themes. These themes are shown in *Table 4.2*.

Table 4.2

Main themes of tutors' experiences learning how to teach

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Learning Experiences										
	How to teach										
1	I learned to understand learners and accommodated their differences	√	√	√	√	√	√	√	√	√	**9**
2	I learned to teach a lesson by presenting content in different ways to make sure all learners understood	√	√	√	√	√	√	√	√	√	**9**
3	I learned to be approachable and created an environment for learners to ask questions		√				√	√	√	√	**5**
4	I faced challenges while tutoring but learned how to deal with it by trying different things to overcome challenges			√	√	√		√	√		**5**
5	I learned patience working with learners	√		√	√	√					**4**

All the tutors experienced that the tutor programme taught them to understand learners and accommodate their differences. They also learnt that they must present the same content differently to ensure that all their learners understood the lessons. Five tutors felt it was important that the learners experienced them as approachable so that they would ask questions. Five tutors overcame the challenges they experienced during tutoring sessions through a what-works approach during their lessons, and four tutors learnt patience working with learners.

Learning the content to teach

The analysis of the tutors' responses to their experiences learning the content to teach revealed six main themes. These themes are shown in *Table 4.3*.

Table 4.3

Main themes of tutors' experiences learning the mathematical content to teach

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Learning Experiences										
	Content to teach										
1	Group discussions during tutor training sessions were important and addressed any misunderstandings I had about the lessons	√	√	√	√	√	√	√	√	√	**9**
2	The way the lesson plans were written, set-by-step, made it easy for me to follow and learn the content to teach	√	√	√	√	√	√	√	√	√	**9**
3	It helped me to study the lesson the day before the tutoring session so that I am prepared when I come to school	√	√	√	√	√		√	√	√	**8**
4	I learned from other tutors when they presented their lessons to the group during tutor training sessions	√	√	√		√	√	√			**6**
5	The photos/pictures in the lesson plans were very helpful			√	√	√		√	√	√	**6**
6	The mathematics content we taught the learners was new to me			√	√	√	√				**4**

All the tutors felt that the group discussions during training sessions preceding learner interventions were important for lesson preparation. Although most tutors studied the lesson plan the day before learner interventions, group discussions were a crucial part of the lesson preparation process for all the tutors. Some tutors even said they could not present their lessons without these discussions. All the tutors indicated that the lesson plans were easy to understand and helped them to learn the lessons. Tutors liked the detailed design of the lesson plans explaining step-by-step how the lessons should progress. Most tutors also found the photos or pictures in the lesson plans, presenting certain steps as visual images (where applicable), very helpful. Another crucial part of the lesson preparation process was when I asked tutors to present lessons to the tutor group as part of the training process. This gave tutors extra ideas on presenting their lessons, and in this way, they learnt from each other. Four tutors said the mathematics content they taught was new to them.

4.3.2. Tutors' teaching experiences

The second sub-question was:

How did tutors experience the teaching aspects in the intervention model regarding teaching small groups, teaching the lesson content and teaching with other tutors?

The following diagram is an extract of the tutors' teaching experiences of the conceptual framework (sub-constructs 4-6) illustrating the part of the framework that applies to sub-question 2.

Figure 4.12

Extract from the conceptual framework of the tutors' teaching experiences
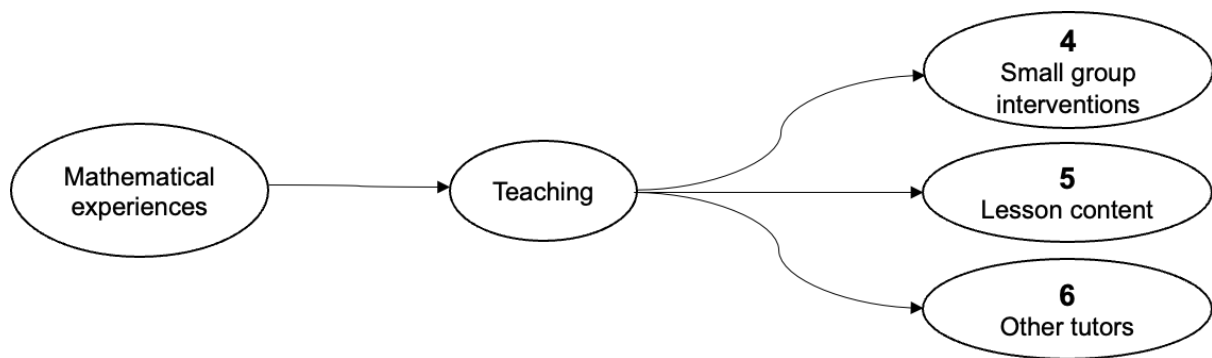
Teaching small groups

The analysis of the tutors' responses to their experiences teaching small groups revealed six main themes. These themes are shown in *Table 4.4.*

Table 4.4

Main themes of tutors' experiences teaching small groups

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Teaching Experiences										
	Small groups										
1	I could attend to all learners' needs	√	√	√	√	√	√	√			7
2	Small groups made tutoring easy	√	√	√	√	√					5
3	Small groups boosted tutor confidence	√	√		√		√				4
4	I felt I could control a small group and learners cooperated			√		√				√	3
5	Small groups boosted learner confidence	√								√	2
6	Grouping learners according to academic needs worked well							√	√		2

Analysing tutors' teaching experiences working with small groups showed that tutors felt they could attend to all the learners' needs in their groups. Tutoring small groups boosted the tutors' confidence and made tutoring easy for them. Four tutors' experiences were that they could control a small group, and learners cooperated, and two tutors thought it boosted learners' confidence. Although the model's intended

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design was based on grouping learners according to their academic needs, only two tutors said this *"worked well"* as part of their experiences teaching small groups.

Teaching the lesson content

The analysis of the tutors' responses to their experiences teaching the lesson content revealed three main themes. These themes are shown in *Table 4.5*.

Table 4.5

Main themes of tutors' experiences teaching the lesson content

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Teaching Experiences										
	Lesson content										
1	All the visuals in the lessons i.e. place value cards, counters, drawings, base ten blocks, games and writing in words significantly influenced learners' progress	√	√	√			√	√		√	**6**
2	The lesson content was not enforcing methods but aim to improve the learners' understanding	√			√			√	√		**4**
3	The best lessons had real-life examples	√					√			√	**3**

Most tutors agreed that using visual manipulatives in the lessons to represent the same concepts differently influenced learners' progress. Four tutors believed the content focused on improving learners' understanding, and three thought the best lessons had real-life examples.

Teaching with other tutors

The analysis of the tutors' responses to their experiences teaching with other tutors revealed five main themes. These themes are shown in *Table 4.6*.

Table 4.6

Main themes of tutors' experiences teaching with other tutors

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Teaching Experiences										
	Other tutors										
1	I see the other tutors as my colleagues/friends/siblings/family		√	√	√	√	√	√	√	√	**8**
2	We helped each other and solved problems together	√	√	√		√	√		√	√	**7**
3	We worked together as a team		√		√		√		√	√	**5**
4	We developed a strong bond over the years which improved our teamwork				√	√		√		√	**4**
5	We supported each other emotionally				√		√		√	√	**4**

Most tutors used the following words on how they saw each other: friends, siblings, family and colleagues. Tutors felt they helped each other, solved problems and worked as a team. Four tutors felt they developed a strong bond over the years and gained experience getting to know each other's strengths, which improved their teamwork. Four tutors experienced that they gave each other emotional support.

4.3.3. Tutors' personal experiences

The third sub-question was:

> *What were tutors' personal experiences in the intervention model about job preparation, future career decisions, social and emotional well-being, adult development and socialisation?*

The following diagram is an extract of the tutors' personal experiences of the conceptual framework (sub-constructs 7-11) illustrating the part of the framework that applies to sub-question 3.

Figure 4.13

Extract from the conceptual framework of the tutors' personal experiences
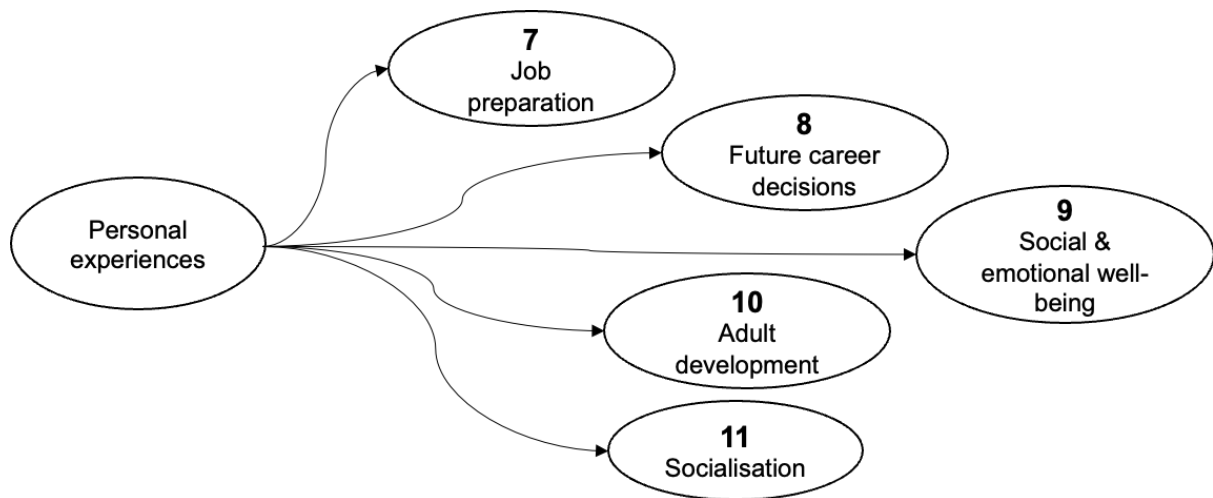
I decided to present all the tutors' personal experiences in one table because some experiences could be categorised into multiple constructs. For example, if a tutor experienced improved communication skills, this could be categorised as job preparation, adult development and socialising. The analysis of the tutors' responses to the four constructs for personal experiences revealed 22 main themes. The themes are shown in *Table 4.7.*

Table 4.7

Main themes of tutors' personal experiences

		Sihle	Towani	Pemma	Phuti	Ziyani	Jabula	Mnguni	Sally	Mandy	Number of responses
	Personal Experiences										
1	It influenced/will influence my parenting	√	√	√	√	√	√	√	√	√	9
2	It prepared me for a job one day	√	√	√	√	√	√	√	√	√	9
3	I learned to interact with people	√	√	√	√	√	√	√	√	√	9
4	It encouraged me to become a teacher one day		√	√	√	√	√	√	√	√	8
5	I learned to work in a team	√	√	√	√	√	√	√	√		8
6	I learned communication skills	√	√	√	√	√	√		√	√	8
7	I learned to manage my time and be punctual	√		√	√	√	√	√	√	√	8
8	The programme made me happy	√	√		√	√	√	√	√	√	8
9	I would teach at a rural school one day because rural learners need a lot of attention		√		√	√	√	√	√	√	7
10	I learned to solve problems in my life	√	√	√	√		√	√		√	7
11	I want to use the skills I learned to change things in my community	√	√		√	√	√	√		√	7
12	It boosted my self-esteem and build my self-confidence	√			√	√	√	√	√		6
13	I became hard-working	√				√	√	√			4
14	I learned to listen	√	√			√	√				4
15	I learned patience			√	√	√					3
16	I learned discipline	√		√	√						3
17	I learned to be responsible				√	√	√				3
18	I learned how to set and achieve goals in my life	√	√	√							3
19	I learned how to plan	√		√							2
20	It showed me education is important		√		√						2
21	It helped me realise my potential			√							1
22	It made me willing to learn				√						1

All the tutors indicated that the tutor programme prepared them for a job one day due to the skills they learnt from their experiences in the programme. All the tutors indicated that the programme influenced or would influence their parenting one day. Eight tutors indicated that they were encouraged by the programme to become a teacher one day. Seven of these tutors indicated they would teach at a rural school because rural learners need a lot of attention due to socio-economic circumstances. The programme positively influenced most tutors' social and emotional well-being. Eight tutors felt that the programme made them happy, and six tutors said it boosted their self-esteem and built their self-confidence. The programme positively influenced most tutors' adult development, saying they learnt how to solve problems in life, became hard-working, learnt patience, discipline, to be responsible and how to plan and achieve goals in their lives. Most tutors experienced personal development through socialising with each

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other and teamwork. The socialising skills tutors learnt from their experiences were interacting with people, teamwork, communication skills and listening skills.

4.3.4. Contribution of the tutors' experiences to the current model or similar tutor-based interventions

The fourth sub-question was:

How can the three aspects of the tutor programme, i.e., tutors' learning, teaching and personal development, be refined to improve the implementation of the mathematics intervention model and inform other similar tutor-based interventions?

I answered sub-question 4 by working through all the findings of the first three sub-questions and identifying areas of potential improvement. I found an area of potential improvement to refine the current model and inform other similar EGM interventions. The shortcoming I identified was that the tutor programme relied on tutors' practical experiences, with limited integration of theory into practice. Although the tutor programme was never intended to be a teacher education programme, tutors were exposed to field experiences and developed teaching skills. It was found that although tutors gained good teaching experience, they relied only on practice. The literature warns against the approach of "practice first, theory later" (Korthagen, 2018, p. 45). An area of potential improvement to refine the current model and inform other similar EGM interventions is incorporating the tutor programme, as part of an academic curriculum for teacher education. This thought is explored in Chapter 5.

4.4. Conclusion

In this chapter, I analysed each tutor's learning experiences, teaching experiences, and personal experiences distinguishing between the sub-constructs of the conceptual framework within each of these experiences. I presented a summarised circle diagram and described the salient points of each tutor's experiences. Then, I summarised the findings for tutors' experiences by following the same structure I used in analysing their experiences. I also summarised the findings for the tutors' learning experiences, teaching experiences and personal experiences, while addressing the sub-constructs within each. My analysis of the findings for sub-constructs 1 to 11 provided me with

the answers to the first three sub-questions. Then I worked through the findings for all the sub-constructs and answered sub-question 4. In this way, I answered the main research question.

Chapter 5: Conclusions and recommendations

5.1. Introduction

This final chapter interprets the study's findings to draw conclusions and answer the main research question. I chose social constructivism as the approach in my study to develop a focused conceptual framework (section 2.8) that I could apply in dealing with tutors' experiences. The conceptual framework consisted of three main constructs and 11 sub-constructs, which were, as described by Nieuwenhuys (2020), logical "bins" (p. 82) I used to collect and analyse the data and interpret the findings. I found this process adequate and efficient to evaluate the tutor programme. A synopsis of the interpretation of the findings in response to the main research question is first discussed. Then, a summary of the report is discussed followed by the study's limitations and contributions. Thereafter, I discuss the recommendations for policy and practice, further research and development work, and close the chapter with the conclusions that emerged from the study.

5.2. Interpretation of the findings

This section presents a summary of the findings as they are interpreted to answer the following four sub-questions, and subsequently the main research question:

How can the experiences of unemployed youth, tutoring mathematics to Grades 4 and 5 learners as part of a tutor programme in a mathematics intervention model (Figure 1.1, part B, section 1.2) be used to refine the model and inform other similar tutor-based interventions?

a) *How did the tutors experience the learning aspects in the intervention model regarding learning mathematics content enhancement, learning how to teach and learning the content to teach (intersection B with A)?*

b) *How did the tutors experience the teaching aspects in the intervention model regarding teaching small groups, teaching the lesson content and teaching with other tutors (intersection B with C)?*

c) *What were the tutors' personal experiences in the intervention model about job preparation, future career decisions, social and emotional well-being, adult development and socialisation (part B)?*

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d) *How can the three aspects of the tutor programme, i.e., tutors' learning, teaching and personal development, be refined to improve the implementation of the mathematics intervention model and inform other similar tutor-based interventions?*

I answered the first sub-research question by discussing the interpretation of my findings for the tutors' learning experiences. Then, I answered the second sub-research question by discussing the interpretation of the findings for the tutors' teaching experiences, and lastly, I answered the third sub-research question by discussing the interpretation of the findings of the tutors' personal experiences. Then, I answered sub-question 4 by working through the findings for all the sub-research questions. In this way, I answered the main research question. The questions were structured in such a way that answering the sub-questions provided the answer to the main research question. What follows is a summary of the sub-questions' findings and interpretation.

a)   Tutors' learning experiences

Learning own content enhancement

Tutors experienced that the programme improved their mathematical knowledge and, for some tutors, changed their understanding of basic mathematical operations. All the tutors passed Grade 12 in the CAPS mathematics curriculum (as opposed to mathematics literacy) in South Africa. Tutors' responses agreed with the literature that although young South African adults pass mathematics in Grade 12, it does not mean they have mastered the concepts in the curriculum (Taylor, 2021). Tutors did not realise that mathematical problems can be represented as real-life examples. South African learners are taught to pass mathematics at different levels but lack the understanding to connect mathematical concepts to real-life situations to improve their lives (Jojo, 2020). Spaull et al. (2022) point out that South African learners progress to higher grades despite not having a basic understanding of numbers, the base-ten system or the four operations. This explains why tutors experienced that the programme improved their mathematical knowledge of basic mathematics operations. Taylor (2021) states that high school learners pass the NSC mathematics examination by merely substituting numbers into formulae. This is why tutors' perceptions of mathematics changed. In school, they thought mathematics was about textbooks,

writing number symbols and following steps to solve mathematical problems. The tutors received their mathematics education in a flawed system, and added to this, these tutors only needed 30% to pass mathematics in Grade 12 (Jojo, 2020). Therefore, undoubtedly, tutors were also learners in the programme, and they learnt 'with' the learners.

Tutors experienced that the programme improved their problem-solving skills in their personal lives. The idea of many solutions that can be used to solve the same mathematical problem was new to most of the tutors. The literature recognises these experiences are interrelated (Schoenfeld, 2016). Learning to understand and solve mathematical problems develops one's ability to use mathematics practically in dealing with problems and situations, thinking through issues and analysing the logic in a situation (Schoenfeld, 2016). However, students' abilities to develop and use these problem-solving skills are influenced by their beliefs about the nature of mathematics (Schoenfeld, 2016). Schoenfeld (2016) states that if teachers don't assert "a belief in problem-solving" (p. 27), students don't expect to understand mathematics and default to believing mathematical problems only have one right answer, which is the only way the teacher presents it. He further explains that this leads to students expecting to solve problems by rote, memorising a machine-like routine without understanding. It is evident from the literature that tutors' understanding and solving of mathematical problems in the tutor programme developed their abilities to use mathematics in practical ways, applying mathematical solutions to real-life situations.

Learning how to teach

Tutors' learning experiences on how to teach are well covered in the literature. The tutors gained knowledge of learners and their characteristics and needs, the mechanics of learner groups, and possible barriers to learning, which are all, amongst others, listed by Gravett et al. (2015), as part of the knowledge bases of good teaching. The competencies required by a teacher as a mediator of learning listed by Nieman and Monyai (2012), also correspond to tutors' teaching experiences, such as being sensitive to learners' differences, actively involving learners in the lessons and encouraging an inquiring attitude in learners. Korthagen (2018) warns about the approach of "practice first, theory later" (p. 45) and alerts educators against programmes where beginner teachers receive limited theoretical background, and

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teacher education becomes an induction process guiding the 'know-how' of teaching. Although the tutor programme was never intended to be a teacher education programme, it is important to contextualise this finding. The tutor programme relies on the tutors' practical experiences, with limited integration of theory into practice. Although tutors are exposed to field experiences and are developing teaching skills, it cannot replace teacher education. However, it can contribute towards teacher education. The literature states that exposing pre-service teachers to practice gave them a better understanding of the teaching profession and the realities of teaching learners from diverse backgrounds (Zhang et al., 2011). It allows them to develop essential skills to advance as mathematics educators (Hinojosa & Bonner, 2021). Van Putten et al. (2023) believe the Bachelor's degree in Education in South Africa is generally very theoretical, with a large gap between the practice and theory. Integrating the tutor programme into an academic curriculum for teacher education could potentially address the gap between theory and practice. Young adults participating in the tutor programme, or similar EGM interventions, can study teacher education while gaining teaching experience as part of their practical work.

Learning the content to teach

Currently, insufficient literature exists which deals directly with tutor training in small groups to deliver mathematics intervention lessons to Grades 4 and 5 learners in rural schools. However, the benefit of small group training is well described in the literature (McKimm & Morris, 2009; Merrit, 2016; Springer et al., 1999). This was also found in the tutors' experiences in learning the content to teach, revealing that group discussions and tutors presenting lessons to the tutor group seem crucial as part of their lesson preparation during tutor training sessions. The mathematics content tutors learnt to teach was new to some of them, which correlates with a previous finding in this section that tutors learnt 'with' the learners. The literature also reflects the tutors' reliance on group training and detailed step-by-step lesson designs. Bowie et al. (2022) explain that using unemployed youth in the OLICO intervention programme requires comprehensive, structured and detailed material design and well-planned facilitator training.

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b)   Tutors' teaching experiences

Teaching small groups

The small group strategy is a well-known researched-based (evidence-informed) practice (McKimm & Morris, 2009; Merrit, 2016; Springer et al., 1999). The design of the intervention model was first and foremost based on this strategy to overcome the challenges of large classes at rural schools with the intended benefits for the learners. This was found in the tutors' responses that they felt they could attend to all the learners' needs in their groups. The literature addressed how the achievement in mathematics of learners from disadvantaged communities improved in three large public high schools in South Africa, through personal attention to "nurture learner success", and after-school one-on-one tutoring sessions (Du Plessis, 2020, p. 27). This study revealed the unintended benefits of tutoring small groups, showing that small group learning benefits both learners and tutors in this context. Working with small groups made tutoring easy for the tutors and gave them confidence in teaching the learners. The literature on small-group tuition reveals the benefits to the learners, but there is a paucity of literature on the benefits for the tutors. Tutors started in the tutor programme without teaching qualifications or tutoring knowledge and experience. They could only gain their knowledge and experience and build confidence through practical experiences. It was found to be a safe environment for unqualified and inexperienced young unemployed adults to gain knowledge and experience, tutoring mathematics. Therefore, the small group setting benefited both learners and tutors in this context.

Teaching the lesson content

The three main themes that emerged from the tutors' experiences are instructional practices described in the literature to promote mathematics learning: using manipulatives in teaching and learning mathematics (Larbi & Mavis, 2016; Mpofu et al., 2021; Sarama & Clements, 2016), teaching mathematics for conceptual understanding and connecting and applying mathematical concepts to learners' daily lives (Gravemeijer & Cobb, 2001; Haylock, 1991). I also referred to these as part of the context of my study in section 3.5.1. Tutors have limited academic knowledge of the theories supporting these practices in mathematics education. Regardless, the influence of these practices still emerged from their teaching experiences, most tutors

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believed these practices influenced learners' progress and improved their understanding.

Teaching with other tutors

Haas and Mortensen (2016) discuss in the Harvard Business Review with the spotlight on managing teams that studying successful teamwork in the workplace remains an ongoing topic. I designed and implemented the tutor programme and was well aware of the importance of teamwork, but I underestimated the tutors' reliance on each other to solve problems and for emotional support as revealed by their experiences. Tutors tutoring with other tutors as part of a team, positively influenced their participation experiences as they felt connected and part of a social network contributing to their sense of belonging; seeing the team as their family.

c) Tutors' personal experiences

Tutors' personal experiences revealed that the tutor programme could contribute to overcoming a major employment problem in their increased abilities to transition to the workplace (Fox & Kaul, 2018), also described in the literature as "skills-to-economic-opportunity" (Johnstone & Schowengerdt, 2022, p. 2). Their personal experiences also showed that the influence of the tutor programme could flow through to the tutors' community and could have a sustainable long-term effect on future generations in rural communities. It was found that the tutor programme encouraged the tutors to consider teaching as a future career. It provided practical teaching experiences to individuals from rural backgrounds. They were from the same communities as the learners and played an essential role in understanding their circumstances. The literature recommends that attempts be made to recruit candidates from rural backgrounds to teach in rural schools because these individuals have the personalities or educational backgrounds to adapt and deal with rural living and teaching challenges in rural schools (Du Plessis & Mestry, 2019). The literature highlights the inadequate supply of well-qualified teachers as one of the challenges rural schools face (Du Plessis, 2017; Du Plessis & Mestry, 2019). The tutor programme can be a means to identify future teachers with rural backgrounds suited to cope with the challenges of teaching in rural schools. The literature showed that developing important aspects of youths' lives, such as interpersonal relationships, aspirations, and social networks in the

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community, could convert their capabilities to transition to the workplace (Johnstone & Schowengerdt, 2022). The literature also points out that the people in a rural community are its human resources and assets for improvement, and a community's development is only sustainable if its people's capabilities are recognised and developed (Suryani & Soedarso, 2021). The tutor programme recognises this by utilising and developing the tutors' capabilities to teach mathematics. It was found that the tutor programme positively influenced the tutors' personal development in all four aspects: job preparation, future career decisions, social and emotional well-being, adult development and socialising. The literature confirms that positive youth development leads to mature adults who can contribute to a country's economy (Fox & Kaul, 2018). Tutors' participation in the tutor programme could potentially contribute to them becoming mature adults in society one day, constructively contributing to South Africa's future economy.

d) Contribution of the tutors' experiences to the current model or similar tutor-based interventions

I answered sub-question 4 by working through all the findings of the first three sub-questions and identifying areas of potential improvement. I found an area of potential improvement to refine the current model and inform other similar EGM interventions. Although tutors gained teaching experiences forming part of good teaching knowledge (Gravett et al., 2015; Nieman & Monyai, 2012), they relied only on practice. The literature warns against the approach of "practice first, theory later" (Korthagen, 2018, p. 45). Implementing the mathematics intervention model can be refined by incorporating the tutor programme as part of an academic curriculum for teacher education. A practical example is one of the tutors who participated in this study was doing the Higher Certificate in Education at UNISA. After completing the certificate, he planned to pursue a Bachelor of Education at UNISA (he studied with an NSFAS bursary). He said he used the experiences he gained in the tutor programme to answer questions in his UNISA assignments. This could also inform other similar EGM interventions. The literature discusses a mathematics service-learning-tutoring project at the University of Georgia (Zhang et al., 2011) and a community mathematics tutoring project in Australasia (Hinojosa & Bonner, 2021). Van Putten et al. (2023) believe that the Bachelor's degree in Education in South Africa is generally very

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theoretical with a large gap between the programme's practical and theoretical work. Venkat et al. (2022) recommend that the knowledge gained from the WMC-P should be applied to the Bachelor of Education pre-service mathematics teacher education programmes. Young adults participating in the tutor programme, or similar EGM interventions, can study teacher education while gaining teaching experience in the programmes as part of their practical work.

The findings and interpretations of the sub-questions answered the main research question. The experiences of unemployed youth tutoring mathematics to Grades 4 and 5 learners as part of a tutor programme in a mathematics intervention model revealed that tutors' mathematical knowledge and understanding of valuable subject content improved. They acquired essential skills on how to teach it and experienced positive personal development. The mathematics intervention model (described in section 1.2) can be refined by incorporating the tutor programme as part of an academic curriculum for teacher education. The study can inform other similar tutor-based EGM interventions by advising that young adults participating in similar EGM interventions study teacher education while gaining practical experiences. Their practical experiences can expose them to mathematical and pedagogic content knowledge to teach mathematics. Their personal experiences can prepare them for the workplace, guide them on future career choices, and contribute to their social and emotional development, adult development and social skills.

5.3.   Summary of the study

In this study, I evaluated a tutor programme based on a mathematics intervention model utilising unemployed rural youth who passed mathematics in Grade 12 as tutors at a low-resourced rural school in Mpumalanga. The primary goal of the intervention model, on which the tutor programme was based, was to improve Grades 4 and 5 learners' performance in mathematics. The secondary goal was to allow unemployed rural youth to be developed and empowered as mathematics tutors by working directly with the learners. The study investigated and described the participation experiences of these tutors in terms of the learning and teaching aspects of the model, as well as their personal journey from unemployment to tutoring. This investigation allowed a streamlining of the existing model and the possibility of informing other similar tutor-based EGM interventions. I used social constructivism as the approach in my study to

develop a focused conceptual framework for tutors' key participation experiences. I used the conceptual framework to collect and analyse the data and interpret the findings and found this process adequate and efficient. The study adopted qualitative methodology and a layered case-study research design. The two target populations were rural South African schools and unemployed rural South African youth, and samples were purposively selected. The already accumulated data were studied "in arrears" (post-hoc) through document analysis, and thereafter, the still-needed data were collected through semi-structured interviews and questionnaires and thematically analysed. The findings and interpretations of the sub-questions answered the following main research question: "How can the experiences of unemployed youth, tutoring mathematics to Grades 4 and 5 learners as part of a tutor programme in a mathematics intervention model (*Figure 1.1,* part B, section 1.2) be used to refine the model and inform other similar tutor-based EGM interventions?". The study revealed that tutors' mathematical knowledge and understanding of valuable subject content improved. They acquired essential teaching skills and experienced positive personal development regarding job preparation, future career decisions, social and emotional well-being, adult development and socialising. The mathematics intervention model can be refined by incorporating the tutor programme as part of an academic curriculum for teacher education. Other similar tutor-based EGM interventions can potentially allow young adults who participate in the interventions to study teacher education while gaining practical experiences. It is recommended that they are developed with a dual focus; academic and personal development. The academic focus can contribute to identifying and training suitable candidates for future mathematics teachers for the early grades. Their practical experiences can expose them to mathematical and pedagogic content knowledge to teach mathematics. Personal development focus can prepare them for the workplace, provide guidance and assistance on future career choices, and contribute to their social and emotional development, adult development and social skills. In this way, EGM interventions utilising unemployed youth can create a sustainable long-term influence on unemployed youth and their communities.

5.4. Limitations

The study was limited to implementing the mathematics intervention model in one rural school in Mpumalanga. The school and tutors did not represent the target population;

the study generated limited data and the findings cannot be generalised. However, I provided sufficient contextual information to enable readers to make a transfer by connecting elements of the study to their own research. The study only provided contextual information on the tutor programme because a complete description of all its components is outside the study's scope. The role of language in the tutor programme was tangential to this study (Essien & Sapire, 2022; Graven et al., 2022; Haylock, 1991; Porteus, 2022) and was not investigated, but it needs further research. A further limitation is that my study does not provide evidence of learners' improvement because it is outside my study's scope and could be part of future research. Learner outcomes are important as the primary goal of the intervention, and I would like to note that the learners' mathematics performances have been promising since 2021. Lastly, the study did not investigate the entry criteria of unemployed youth passing Grade 12 mathematics to participate in the interventions. My experience was that some tutors performed better than others in understanding and presenting the lesson content. However, I have not conducted any research to find out whether this was linked to their mathematics performance in Grade 12 or not. This would require further research.

5.5.   Contributions of the study

Researchers, universities, NGOs, the government and well-known authors in the field of EGM interventions may find this study useful because of the outcomes of this study linking EGM interventions with the development of unemployed youth in South Africa. This study may also contribute to the identification and training of future mathematics teachers in rural schools in South Africa because of the study's rural context.

5.6.   Recommendations

It is recommended that universities, NGOs and EGM interventions utilise unemployed youth partners to focus on creating a sustainable long-term influence on the unemployed youth in the interventions and their communities. In this way, EGM interventions utilising unemployed youth can improve learners' mathematical learning while simultaneously developing unemployed youth and their communities. A pre-requisite for participation in the interventions could be that individuals have to have

passed mathematics Grade 12. These individuals could be trained and developed with the dual focus of academic and personal development.

The academic focus would involve universities incorporating the EGM interventions as part of the practical work in their Bachelor's degree in education teacher training programmes in the early grades. This might bridge the theory/practice gap (Van Putten et al., 2023). Were such a qualification to be made available through distance education, these youths could participate in the EGM interventions in remote locations while studying teacher education. Their practical experiences would expose them to mathematical and pedagogic content knowledge to teach mathematics. Venkat and Roberts (2022a) identified one of the priorities for improving outcomes in EGM learning by 2030 as investing in and supporting universities in designing and implementing quality teacher education programmes for mathematics teachers. Spaull and Taylor Field (2022b) pointed out that South Africa needs to train and employ a new era of teachers to help alleviate one of the major underlying causes of South Africa's poor mathematics achievement history. So, already successful EGM interventions can contribute towards future teacher education in South Africa. Deploying EGM interventions utilising unemployed youth in rural schools, could contribute to identifying and training future teachers with rural backgrounds to cope with the challenges of teaching in rural schools (Du Plessis & Mestry, 2019).

As far as the EGM interventions' personal development focus on unemployed youth is concerned, it is recommended that such interventions address employability skills to prepare unemployed youth for the workplace, provide guidance and assistance on future career choices, and contribute to these individual's social and emotional development, adult development and social skills. Based on the study conducted by Fox and Kaul (2018), one could argue that the EGM interventions can contribute to these youths becoming mature adults in society one day, constructively contributing to South Africa's future economy. Influencing these youths on how they think and do things will affect others in the community: children, younger siblings, cousins, friends, neighbours, etc. My study showed that unemployed youth could be developed while simultaneously participating in an EGM intervention and in this way, the intervention could have a sustainable long-term effect on future generations and communities.

5.7.   Conclusions

The literature describes and evaluates a great number of EGM interventions in the most recent comprehensive studies reflecting on the EGM education system in South Africa (Spaull & Pretorius, 2022; Spaull & Taylor, 2022a; Venkat & Roberts, 2022b). In the last volume, Spaull and Taylor (2022b) reviewed 14 interventions in South Africa (for mathematics and reading) from 2010-2020. They concluded that although these interventions vary in scale, they all design and supply materials and/or provide added support and training for teachers and relevant government officials. My mathematics intervention model (described in section 1.2) also fits this description. I designed and used materials primarily for use during interventions and, to a certain extent, in the classroom by the teacher, and the intervention provided support to the mathematics teacher in the form of tutor-led interventions. I refer to tutors, but other similar interventions refer to teacher assistants or facilitators. However, the difference between my study and other EGM intervention studies discussed in the literature is that my study focused on evaluating the intervention by investigating and describing the experiences of tutors as unemployed youth.

The EGM interventions discussed in the literature using unemployed youth all focused on evidence of improving learner outcomes, and rightly so, because that is the primary goal. However, my study focused on unemployed youth experiences in the intervention and does not provide evidence of learners' improvement because it is outside my study's scope. Learner outcomes are, of course, important as the primary goal of the intervention, and I addressed this goal by noting that the learners' mathematics performances have been promising since 2021, which also influenced the programme's funding. Although other similar EGM interventions use unemployed youth, there is a paucity of literature addressing the development and sustainable long-term approach of focusing on these youths while simultaneously addressing learners' performances. Only focusing on the stipends they receive to alleviate their unemployment overlooks the hidden opportunity to uncover this space. It is there, whether explored or not, and needs to be unlocked.

This study showed that tutors' mathematical knowledge and understanding of valuable subject content improved and filled a 'gap' left by their mathematics school education in South Africa. It also revealed that young unemployed adults gained good teaching experiences that could contribute towards teacher education. The study further demonstrated that the programme developed the tutors' 'non-mathematical' skills that influenced how they think and do things. This directly influences them and indirectly affects others in the community. This shows that the influence of the tutor programme (or similar EGM interventions) could flow through to the community and have a sustainable long-term effect on future generations in rural (or other) communities. Passing mathematics in Grade 12 is an achievement for learners in rural schools from low socio-economic communities (Bansilal & Lephoto, 2022). Building the skills base of unemployed youth living in poverty can enable further education, improve career access, and overcome poverty by creating a sustainable long-term effect on the socio-economic status of current and future generations; "a good education is often the only means of breaking the cycle of poverty for rural learners" (Du Plessis, 2014, p. 1115). This focus could be incorporated into EGM interventions utilising unemployed youth, having a sustainable long-term influence on them and their communities. During the course of my research to evaluate this tutor programme, it became clear to me that in this rural community in which I worked, and possibly in other similar communities, there lies a treasure as yet undiscovered. There are untrained, unemployed young people who desperately need only to be connected to a programme such as this one to build up their knowledge and understanding of valuable subject content, including how to teach it and help them become focused, envisioned individuals who recognise the value of pursuing further education.

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References

Adams, W. C. (2015). Conducting Semi-Structured Interviews. In K. E. Newcomer, H. P. Hatry, & J. S. Wholey (Eds.), *Handbook of Practical Program Evaluation* (pp. 492–505). John Wiley & Sons, Inc. https://doi.org/10.1002/9781119171386.ch19

Akpan, D. V. I., Igwe, D. U. A., Blessing, I., Mpamah, I., & Okoro, C. O. (2020). *Social Constructivism: Implications on Teaching and Learning*. 8.

Anh, V. T. K. (2018). Evaluation Models in Educational Program: Strengths and Weaknesses. *VNU Journal of Foreign Studies*, *34*(2). https://doi.org/10.25073/2525-2445/vnufs.4252

Ardington, C. (2023). *Youth employment programmes have the potential to meaningfully impact learning outcomes in the early grades* [Academic]. Southern Africa Labour and Development Research Unit. https://www.saldru.uct.ac.za/2023/04/24/youth-employment-programmes-have-the-potential-to-meaningfully-impact-learning-outcomes-in-the-early-grades/

Ardington, C., & Henry, J. (2021). *Funda Wande Limpopo Evaluation* (p. 64) [Midline Reoprt]. Southern Africa Labour and Development Research Unit. https://fundawande.org/img/cms/news/Limpopo%20TA%20Evaluation%20202 1.pdf

Askew, M. (2013). Big Ideas in primary mathematics: Issues and directions. *Perspectives in Education*, *31*(3), 5–18.

Banerjee, A., Banerhi, R., Berry, J., Duflo, E., Kannan, H., Mukherji, S., Shotland, M., & Walton, M. (2016). *Mainstreaming An Effective Intervention: Evidence From Randomized Evaluations Of "Teaching At The Right Level" In India* (Working

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Paper 22746; NBER Working Paper Series). National Bureau of Economic research. http://www.nber.org/papers/w22746

Bansilal, S., & Lephoto, T. (2022). Exploring Particular Learner Factors Associated with South African Mathematics Learners' Achievement: Gender Gap or Not. *African Journal of Research in Mathematics, Science and Technology Education*, 1–12. https://doi.org/10.1080/18117295.2022.2057730

Barnes, H. E. (2004). *A Developmental Case Study: Implementing the Theory of Realistic Mathematics Education with Low Attainers*. 245.

Barnes, H. E. (2009). *Pre-service teachers' mathematics profiles and the influence thereof on their instructional behaviour*. University of Pretoria.

Barry, M. M., Clarke, A. M., Morreale, S. E., & Field, C. A. (2018). A Review of the Evidence on the Effects of Community-based Programs on Young People's Social and Emotional Skills Development. *Adolescent Research Review*, *3*(1), 13–27. https://doi.org/10.1007/s40894-017-0055-2

Basaran, M., Dursun, B., Gur Dortok, H. D., & Yilmaz, G. (2021). Evaluation of Preschool Education Program According to CIPP Model. *Pedagogical Research*, *6*(2), em0091. https://doi.org/10.29333/pr/9701

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, *9*(2), 27–40. https://doi.org/10.3316/QRJ0902027

Bowie, L., Collins, H., Mashiyane, N., & Matanhike, F. (2022). Maths clubs: Growing the possibilities of the after-school space. In *Early grade mathematics in South Africa* (1st ed., Vol. 2). Oxford University Press Southern Africa (Pty) Limited.

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Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Catalano, R. F., Skinner, M. L., Alvarado, G., Kapungu, C., Reavley, N., Patton, G. C., Jessee, C., Plaut, D., Moss, C., Bennett, K., Sawyer, S. M., Sebany, M., Sexton, M., Olenik, C., & Petroni, S. (2019). Positive Youth Development Programs in Low- and Middle-Income Countries: A Conceptual Framework and Systematic Review of Efficacy. *Journal of Adolescent Health*, *65*(1), 15–31. https://doi.org/10.1016/j.jadohealth.2019.01.024

Cook, D. A. (2010). Twelve tips for evaluating educational programs. *Medical Teacher*, *32*(4), 296–301. https://doi.org/10.3109/01421590903480121

Cousin, G. (2005). Case Study Research. *Journal of Geography in Higher Education*, *29*(3), 421–427. https://doi.org/10.1080/03098260500290967

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed). SAGE Publications.

Department of Basic Education. (2021). *Department of Basic Education Annual Report 2020/2021* (Annual Report 16; p. 404).

Department of Basic Education. (2017). *Poverty ranking of schools (Quintiles)*. https://view.officeapps.live.com/op/view.aspx?src= http%3A%2F%2Fpmg-assets.s3-website-eu-west- 1.amazonaws.com%2F171129Quintiles.pptx.

Du Plessis. (2014). Problems and Complexities in Rural Schools: Challenges of Education and Social Development. *Mediterranean Journal of Social Sciences*. https://doi.org/10.5901/mjss.2014.v5n20p1109

Du Plessis. (2017). Challenges for rural school leaders in a developing context: A case study on leadership practices of effective rural principals. *Koers - Bulletin*

for Christian Scholarship, *82*(3), 2337.

https://doi.org/10.19108/KOERS.82.3.2337

Du Plessis. (2020). Closing the Achievement Gap in Disadvantaged Communities: Lessons from Successful Schools. *Africa Education Review*, *16*(6), 22–36. https://doi.org/10.1080/18146627.2018.1464649

Du Plessis, & Ahmed, L. (2020). Exploring the Anticipated Career Aspirations of Youth in a Rural Secondary School: A Visual Participatory Approach. *Educational Research for Social Change*, *9*(2). https://doi.org/10.17159/2221-4070/2020/v9i2a4

Du Plessis, & Mestry, R. (2019). Teachers for rural schools – a challenge for South Africa. *South African Journal of Education*, *39*(Supplement 1), S1–S9. https://doi.org/10.15700/saje.v39ns1a1774

Duflo, A., Kiessel, J., & Lucas, A. (2022). *Experimental Evidence On Alternative Policies To Increase Learning At Scale* (Working Paper 27298; NBER Working Paper Series). National Bureau of Economic research. http://www.nber.org/papers/w27298

Eagle, L. (2021). *SA needs to rethink the ways maths is taught in pre-school*. https://www.iol.co.za/education/sa-needs-to-rethink-the-ways-maths-is-taught-in-pre-schools-expert-1e22b9d4-21ff-465f-9187-7d10dbbfec8f

Ernest, P. (1991). *The philosophy of Mathematics Education* (1st ed.). Burgess Science Press.

Essien, A., & Sapire, I. (2022). Language policy implementation in early grade mathematics in South Africa: A 2010–2020 overview. In *Early grade mathematics in South Africa* (1st ed., Vol. 2). Oxford University Press Southern Africa (Pty) Limited.

Fox, L., & Kaul, U. (2018). *The Evidence Is In: How Should Youth Employment Programs In Low-Income Countries Be Designed?* World Bank, Washington, DC. https://doi.org/10.1596/1813-9450-8500

Frye, A. W., & Hemmer, P. A. (2012). Program evaluation models and related theories: AMEE Guide No. 67. *Medical Teacher*, *34*(5), e288–e299. https://doi.org/10.3109/0142159X.2012.668637

García, O., & Wei, L. (2014). *Translanguaging: Language, Bilingualism and Education, by Ofelia García and Li Wei* (1st ed.). Macmillan.

Gravemeijer, K., & Cobb, P. (2001). Learning for life in the 21st century: Sociocultural perspectives on the future of education. *Choice Reviews Online*, *40*(07), 40-4131-40–4131. https://doi.org/10.5860/CHOICE.40-4131

Graven, M., Vale, P., Hokonya, W., & Long, R. (2022). A decade of the South African Numeracy Chair Project: Out-of-school learner-focused interventions. In *Early Grade Mathematics in South Africa* (1st ed., Vol. 2). Oxford University Press Southern Africa (Pty) Limited.

Gravett, S., de Beer, J., & du Plessis, E. (2015). *Becoming a Teacher* (6th ed.). Pearson.

Haas, M., & Mortensen, M. (2016). The Secrets of Great Teamwork. *Harvard Business Review*, *June 2016*, 70–76.

Haylock, D. (1991). *Teaching Mathematics to Low Attainers 8-12*. Paul Chapman Publishing.

Hinojosa, D. M., & Bonner, E. P. (2021). The community mathematics project: Using a parent tutoring program to develop sense-making skills in novice mathematics educators. *Mathematics Education Research Journal*. https://doi.org/10.1007/s13394-021-00401-x

Hlalele, D. (2012). Social justice and rural education in South Africa. *Perspectives in Education*, *30*.

Human Sciences Research Council. (2021). *Publication of the Human Sciences Research Council*. https://hsrc.ac.za/

Johnstone, C. J., & Schowengerdt, B. (2022). More than skills: The importance of social and community connections in youth development. *PROSPECTS*. https://doi.org/10.1007/s11125-021-09586-2

Jojo, Z. (2020). Mathematics Education System in South Africa. In G. Porto Jr. (Ed.), *Education Systems Around the World*. IntechOpen. https://doi.org/10.5772/intechopen.85325

Kilimani, N. (2017). Youth Employment in Developing Economies: Evidence on Policies and Interventions. *IDS Bulletin*, *47*(3). https://doi.org/10.19088/1968-2017.124

Kolb, A. Y., & Kolb, D. A. (2022). Experiential Learning Theory as a Guide for Experiential Educators in Higher Education. *Experiential Learning and Teaching in Higher Education*, *1*(1), 38. https://doi.org/10.46787/elthe.v1i1.3362

Korthagen, F. A. J. (2018). Making teacher education relevant for practice: The pedagogy of realistic teacher education. *ORBIS SCHOLAE*, *5*(2), 31–50. https://doi.org/10.14712/23363177.2018.99

Larbi, E., & Mavis, O. (2016). The Use of Manipulatives in Mathematics Education. *Journal of Education and Practice*.

Levers, M.-J. D. (2013). Philosophical Paradigms, Grounded Theory, and Perspectives on Emergence. *SAGE Open*, *3*(4), 215824401351724. https://doi.org/10.1177/2158244013517243

Maree, K. (2020). *First steps in research* (3rd ed.). Van Schaik Publishers.

Maree, K., & Pietersen, J. (2020). Surveys and the use of questionnaires. In *First steps in research 3* (3rd ed., pp. 196–212). Van Schaik Publishers.

McKimm, J., & Morris, C. (2009). Small group teaching. *British Journal of Hospital Medicine*, *70*(11), 654–657. https://doi.org/10.12968/hmed.2009.70.11.45059

Merrit, M. A. (2016). *Improving student math knowledge and math attitudes through amall group instruction: An action research study*. Capella University.

Mohangi, K., Krog, S., Stephens, O., & Nel, N. (2016). Contextual challenges in early literacy teaching and learning in Grade R rural schools in South Africa. *Per Linguam*, *32*(1). https://doi.org/10.5785/32-1-646

Moloi, Q., Roberts, N., & Thomo, J. (2022). Using NumberSense workbooks and formative assessment to improve learning outcomes in early grade mathematics. In *Early grade reading and mathematics interventions in South Africa* (1st ed.). Oxford University Press Southern Africa (Pty) Limited.

Mpofu, S., Isaac, P., Ndamase, T., Sonjica, L., & Sapire, I. (2021). Bala Wande—Foundation Phase Mathematics OER: Collaborative Development and Use. In D. Burgos & J. Olivier (Eds.), *Radical Solutions for Education in Africa* (pp. 211–231). Springer Singapore. https://doi.org/10.1007/978-981-16-4099-5_11

Nieman, M., & Monyai, R. (2012). *The Educator as Mediator of Learning* (1st ed.). Van Schaik Publishers.

Nieuwenhuis, J. (2020). Analysing qualitative data. In *First steps in research 3* (3rd ed., pp. 80–116, 108–147). Van Schaik Publishers.

Nortje, M. (2017). The effect of poverty on education in South Africa. *Educor Multidisciplinary Journal*, *1*, 47–62.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 160940691773384. https://doi.org/10.1177/1609406917733847

Oluwajodu, F., Blaauw, D., Greyling, L., & Kleynhans, E. P. J. (2015). Graduate unemployment in South Africa: Perspectives from the banking sector. *SA Journal of Human Resource Management*, *13*(1), 9 pages. https://doi.org/10.4102/sajhrm.v13i1.656

Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (Fourth edition). SAGE Publications, Inc.

Porteus, K. (2022). Improving rural early grade mathematics: Design principles and patterns of improvement. In *Early grade mathematics in South Africa* (1st ed., Vol. 2, pp. 97–118). Oxford University Press Southern Africa (Pty) Limited.

Reddy, V. (2021, June). 25 years of TIMSS in South Africa: Improved achievements but pace of improvement is slowing. *HSRC Review*, *19*(2), 4–7.

Reddy, V., & Harvey, J. (2021, June). Language development and Science achievement. *HSRC Review*, *19*(2), 11–13.

Sapire, I., Isaac, P., Mpofu, S., Sako, L., Seoloana, Mm., Ndamase, T., & Mafilika, V. (2022). The implementation of the Bala Wande programme in Grade 1 in three provinces: Lessons learned. In *Early Grade Reading and Mathematics Interventions in South Africa* (1st ed., Vol. 1, pp. 37–63). Oxford University Press Southern Africa (Pty) Limited.

Sarama, J., & Clements, D. H. (2016). Physical and Virtual Manipulatives: What Is "Concrete"? In P. S. Moyer-Packenham (Ed.), *International Perspectives on Teaching and Learning Mathematics with Virtual Manipulatives* (Vol. 7, pp.

71–93). Springer International Publishing. https://doi.org/10.1007/978-3-319-32718-1_4

Schoenfeld, A. H. (2016). Learning to Think Mathematically: Problem Solving, Metacognition, and Sense Making in Mathematics (Reprint). *Journal of Education*, *196*(2), 1–38. https://doi.org/10.1177/002205741619600202

Sharpe, S. T., & Marsh, D. D. (2022). A systematic review of factors associated with high schoolers' algebra achievement according to HSLS:09 results. *Educational Studies in Mathematics*, *110*(3), 457–480. https://doi.org/10.1007/s10649-021-10130-4

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, *22*(2), 63–75. https://doi.org/10.3233/EFI-2004-22201

Spaull, N., Courtney, P., & Qvisy, J. (2022). Mathematical stunting in South Africa: An analysis of Grade 5 mathematics outcomes in TIMSS 2015 and 2019. In *Early Grade Mathematics in South Africa* (1st ed., Vol. 2, pp. 1–14). Oxford University Press Southern Africa (Pty) Limited. http://creativecommons.org/licenses/by-nc-nd/4.0/

Spaull, N., & Kotze, J. (2015). Starting behind and staying behind in South Africa: The case of insurmountable learning deficits in mathemaatics. *International Journal of Education Development*, *41*, 13–24.

Spaull, N., & Pretorius, E. (Eds.). (2022). *Early grade reading in South Africa* (1st ed., Vol. 1). Oxford University Press Southern Africa (Pty) Limited.

Spaull, N., & Taylor, S. (Eds.). (2022a). *Early grade reading and mathematics in South Africa* (1st ed., Vol. 3). Oxford University Press Southern Africa (Pty) Limited.

Spaull, N., & Taylor, S. (2022b). Impact or scale? The trade-offs of early grade reading and mathematics interventions in South Africa. In *Early grade reading and mathematics in South Africa* (1st ed., Vol. 3, pp. 1–24). Oxford University Press Southern Africa (Pty) Limited.

Springer, L., Stanne, M. E., & Donovan, S. (1999). Effects of Small-Group Learning on Undergraduates in Science, Matghematics, Engineering and Technology: A Meta-Analysis. *Review of Educational Research*, *69*(1), 21–51.

Statistics South Africa. (2021, November). *Quarterly Labour Force Survey (QLFS) – Q3:2021*. Statistics South Africa. http://www.statssa.gov.za/?p=14957

Stemler, S. (2015). *Emerging Trends in the Social and Behavioral Sciences*. John Wiley & Sons, Inc. http://sstemler.faculty.wesleyan.edu/files/2016/09/Stemler_Emerging_Trends_in_Content_Analysis_2015.pdf

Stufflebeam, D. L. (2003). CIPP Model for Evaluation. In *International Handbook of Educational Evaluation* (1st ed., pp. 31–62). Kluwer Academic Publisher.

Sullivan, P. (2011). *Australian Education Review* (Publication 59; Teaching Mathematics: Using Research-Informed Strategies, pp. 24–30). Australian Council for Educational Research.

Suryani, A., Muhibbin, Z., & Saifulloh, M. (2022). *Youth as Educators: Cultivating Youth Digital Contribution to Community Education*. *5*(2), 21.

Suryani, A., & Soedarso, S. (2021). Community-based development and collective learning: How does a local community engage and learn to initiate a smart village development? *Journal of Development Research*, *5*(1), 34–40. https://doi.org/10.28926/jdr.v5i1.127

Taylor, N. (2021). The dream of Sisyphus: Mathematics education in South Africa. *South African Journal of Childhood Education*, *11*(1). https://doi.org/10.4102/sajce.v11i1.911

Tuli, F. (2011). The Basis of Distinction Between Qualitative and Quantitative Research in Social Science: *Reflection on Ontological, Epistemological and Methodological Perspectives*. *Ethiopian Journal of Education and Sciences*, *6*(1). https://doi.org/10.4314/ejesc.v6i1.65384

Ukuqonda Institute. (2019). *Key Issues*. Ukuqonda Institute. https://ukuqonda.org.za/

University of the Witwatersrand. (2017). *Mathematics—A gateway to many career paths—Wits University*. https://www.wits.ac.za/news/latest-news/inaugural-lectures/2017/mathematics----a-gateway-to-many-career-paths.html

Van Putten, S., Van Putten, J., & De Jager, L. (2023). Student teachers' perceptions of mentoring as an influencer of their professional teacher identity development. *Mentoring & Tutoring: Partnership in Learning*, *31*(4), 466–488. https://doi.org/10.1080/13611267.2023.2225392

Venkat, H., Askew, M., & Morrison, S. (2022). A decade of the Wits Maths Connect-Primary project (2010-2020): Design research moving promising interventions to scale. In *Early Grade Mathematics in South Africa* (1st ed., Vol. 2). Oxford University Press Southern Africa (Pty) Limited.

Venkat, H., & Roberts, N. (2022a). Children doing mathematics with confidence in the early grades by 2030: What will it take? In *Early Grade Mathematics in South Africa* (1st ed., Vol. 2, pp. 208–224). Oxford University Press Southern Africa (Pty) Limited.

Venkat, H., & Roberts, N. (Eds.). (2022b). *Early Grade Mathematics in South Africa* (1st ed., Vol. 2). Oxford University Press Southern Africa (Pty) Limited.

Venkat, H., & Sapire, I. (2022). Early grade mathematics in South Africa between 2000 and 2010: What did we know in 2010, and how did this set the stage for the 2010–2020 decade? In *Early grade mathematics in South Africa* (1st ed., Vol. 2, pp. 1–14). Oxford University Press Southern Africa (Pty) Limited.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (Sixth edition). SAGE.

Zhang, G., Zeller, N., Griffith, R., Metcalf, D., Williams, J., Shea, C., & Misulis, K. (2011). *Using the Context, Input, Process, and Product Evaluation Model (CIPP) as a Comprehensive Framework to Guide the Planning, Implementation, and Assessment of Service-learning Programs*. 28.

Annexures

Annexure A: Tutor's consent letters

Dear Sir/Madam,

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT:

Evaluating the experiences of unemployed youth tutoring grade 4 and 5 learners as part of a mathematics intervention model at a rural primary school in Mpumalanga

I am currently enrolled for a MEd degree at the University of Pretoria. Part of the requirements for awarding this degree is the successful completion of a research project in the field of education.

The title of my approved research study is:

Evaluating a mathematics tutor programme for unemployed youth in a rural context

This study seeks to evaluate a mathematics intervention model utilising 9 unemployed rural youth as tutors in a mathematics intervention for grade 4 and 5 learners in a low-resourced rural school in Mpumalanga. The tutors all had passed grade 12 Mathematics and were trained and assisted to each work with small groups of grade 4 and 5 learners every week over three years.

1. tutors' experiences in learning the mathematics content of the intervention model.
2. tutors' experiences teaching the intervention model's mathematics content to the grade 4 and 5 learner groups.
3. tutors' personal, emotional, and social learning experiences in the mathematics intervention model.
4. how the experiences of unemployed youth tutoring mathematics to grade 4 and 5 learners at a rural primary South African school can inform similar tutor-based interventions.

Below is the scope and responsibility of your participation. To gather the information that I require for this research, I hereby request permission to interview you about your experiences as part of

the mathematics intervention model implemented at a rural school in Mpumalanga. This interview should take no longer than 45 minutes and can be conducted at the school or any location of your choice. I have included here for your information a schedule of interview questions.

Kindly note that this is a voluntary participation and that permission to participate is further protected by the University of Pretoria. Your participation in this study will in no way either advantage or disadvantage you or any other participant.

Each participant will be free, at any stage during the process and including the stage at which they authenticate the transcript of their interview, to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. Any and all data collected from them up to that point in the study will then be destroyed.

All the information obtained during the research study will be treated confidentially. No person will have access to the raw data, including the Department of Education. Both the interviewee name and the name of the institution in which he or she works will not be revealed in this report.

The findings and the recommendations of this study will be shared with you. This research presents a unique opportunity for you and your school to share and compare best practices with the country and the world and to enable you to further get involved in the process of research aimed at training and preparing South African secondary school teachers for online teaching.

I also would like to request your permission to use your data, confidentially and anonymously, for further research purposes. Further research may include secondary data analysis and use the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

At the end of the research study, you will be provided with a copy of the research report containing the study's findings and recommendations. This research study presents a unique opportunity for you and your school to get involved in the research process aimed at improving the quality of mathematics education in rural South African schools. If you decide to participate in this research study, kindly indicate this by completing the consent form at the end of this letter.

Thanking you in anticipation.

Annexure A

Yours in service of education,

Ms. MA Strydom   Dr. M Mihai

Student Researcher   Supervisor

University of Pretoria   University of Pretoria

mariana@tirongtrust.co.za   maryke.mihai@up.ac.za

(082) 823 9749   (082) 430 2928

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Annexure A

Annexure B: Business consent letter

Faculty of Education

Dear Sir/Madam,

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT:
Evaluating the experiences of unemployed youth tutoring grade 4 and 5 learners as part of a mathematics intervention model at a rural primary school in Mpumalanga

I am currently enrolled for an MEd degree at the University of Pretoria. Part of the requirements for awarding this degree is the successful completion of a research project in the field of education.

The title of my approved research study is:

Evaluating a mathematics tutor programme for unemployed youth in a rural context

This study seeks to evaluate a mathematics intervention model utilising 9 unemployed rural youth as tutors in a mathematics intervention for grade 4 and 5 learners in a low-resourced rural school in Mpumalanga. The tutors all had passed grade 12 Mathematics and were trained and assisted to each work with small groups of grade 4 and 5 learners every week over three years.

You are hereby invited to participate in this research project, which aims to explore:

1. tutors' experiences in learning the mathematics content of the intervention model.
2. tutors' experiences teaching the intervention model's mathematics content to the grade 4 and 5 learner groups.
3. tutors' personal, emotional, and social learning experiences in the mathematics intervention model.
4. how the experiences of unemployed youth tutoring mathematics to grade 4 and 5 learners at a rural primary South African school can inform similar tutor-based interventions.

Faculty of Education
Fakulteit Opvoedkunde
Lefapha la Thuto

Annexure B

Below are the scope and responsibilities of the participants of this study. To gather the information that I require for this research, I hereby request permission to interview 9 tutors enrolled in the mathematics intervention model in 2023 on their experiences as unemployed youth in the mathematics intervention model tutoring grade 4 and 5 learners. These interviews should take no longer than 45 minutes and can be conducted at the school or any other location. I have included here the interview questions from the survey.

Please understand that the decision for your business to participate is completely voluntary and that permission for your participation will also be protected by the University of Pretoria. Kindly also note that each individual's participation in the study will be completely voluntarily and will in no way either advantage or disadvantage them. Each participant will be free, at any stage during the process up to and including the stage at which they authenticate the transcript of their interview, to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. Any and all data collected from them up to that point in the study will then be destroyed.

All the information obtained during the research study will be treated confidentially and no person will have access to the raw data. The interviewees' names will not be revealed in this report. I also request your permission to use the participants' data, confidentially and anonymously, for further research. Further research may include secondary data analysis and use the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

At the end of the research study, you will be provided with a copy of the research report containing the study's findings and recommendations. This research study presents a unique opportunity for you and your business to get involved in the research process aimed at improving the quality of mathematics education in rural South African schools. If you decide to participate in this research study, kindly indicate this by completing the consent form at the end of this letter.

Yours in service of education,

Ms. MA Strydom	Dr. M Mihai
Student Researcher	Supervisor
University of Pretoria	University of Pretoria
mariana@tirongtrust.co.za	maryke.mihai@up.ac.za
(082) 823 9749	(082) 430 2928

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Annexure B

LETTER of CONSENT

BUSINESS AS PARTICIPANT

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

Evaluating unemployed youth's experiences as tutors in a mathematics intervention model tutoring grades 4 and 5 learners at a rural primary school in Mpumalanga.

I, _____, the trustee of
_____hereby voluntarily and willingly agree
to allow the business to participate in the above-mentioned study introduced and explained to me
by Mariana Strydom, currently a student enrolled for an MEd degree at the University of Pretoria.

I further declare that I understand, as explained to me by the researcher, the aim, scope, and
purpose of collecting information proposed by the researcher, as well as how the researcher will
attempt to ensure the confidentiality and integrity of the information he collects.

_____   _____
Full name   Signature

_____
Date

Annexure C: Tutors' questionnaires

Tutor Name:_____

1. How has the Tutor program affected or changed your life during 2020?

_____
_____
_____
_____
_____
_____

2. What are you learning from the Tutor Program?

_____
_____
_____
_____
_____
_____

3. What do you love about working with children?

_____
_____
_____
_____
_____
_____

Annexure C

September 2021

Tutor Name:_____

Write down <u>three things</u> that you learned from the Tutor Development Program in 2021?

_____
_____
_____
_____
_____
_____

Write down two things that worked well this year?

_____
_____
_____
_____
_____
_____

Write down one thing that did <u>not</u> work so well this year?

_____
_____
_____
_____
_____
_____

What are your recommendations to improve the program?

_____
_____
_____
_____
_____
_____

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Annexure C

Tutor Name:_____

Write down <u>three things</u> that you learned from the Tutor Development Program in 2022?

_____

_____

_____

Write down two things that worked well this year?

_____

_____

_____

Write down one thing that did <u>not</u> work so well this year?

_____

_____

_____

What are your recommendations to improve the program?

_____

_____

_____

What are your needs for the Tutor Development Program? In other words, what do you <u>require</u> from the program?

_____

_____

_____

Does the Tutor Development Program satisfy your needs? Why do you say so?

_____

_____

_____

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Annexure C

*Answer each question by **circling** the appropriate **box** or by **writing** your opinion in the space provided.*
Please complete all the items.

Name:_____

Gender:_____

Age:_____

Home Language:_____

		Strongly agree	Agree	Disagree	Strongly disagree
1	I see myself as an "agent of change" as part of the Tutor Development Program	1	2	3	4
2	I see myself as a "community educator" that contributes to the education of the children in my community	1	2	3	4
3	The Tutor Development Program helps me to influence my community	1	2	3	4
4	The Tutor Development Program prepares me for a job	1	2	3	4
5	The Tutor Development Program influences my future	1	2	3	4
6	The Tutor Development Program influences my choice of a career	1	2	3	4
7	The Tutor Development Program will contribute to overcoming poverty in the community	1	2	3	4
8	The Tutor Development Program positively influence my development as an adult	1	2	3	4

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9   **How long have you been participating in the Tutor Development Program?**

1 year	1
2 years	2
3 years	3

10   **Does the Tutor Development Program develop your skills and capabilities?**

Yes	1
No	2
If yes, specify which skills and capabilities	

11   **Does the Tutor Development Program contribute to your social and emotional well-being?**

Yes	1
No	2
If yes, specify how	

12   **Does the Tutor Development Program encourage/motivate you to be a qualified teacher one day?**

Yes	1
No	2
If yes, specify why	

13   **If you answered yes to the previous question, where would you prefer to teach?**

Rural school	1
Urban school	2
City school	3
Specify why	

Annexure C

14   What other things are you doing when you are not at the Tutor Development Program?

Nothing	1
Studying	2
Working part-time	3
Other (specify)	

15   Will you be able to use the skills that you developed in the Tutor Development Program in the community?

Yes	1
No	2

Why do you say so?

16   Will the skills you developed in the Tutor Development Program motivate you to leave or stay in the community?

Leave the community	1
Stay in the community	2

Why do you say so?

Annexure D: Tutors' interview schedule

1. You receive your lessons the day before the session at school, and then you receive training during the tutor training session before a lesson. What helps you to learn the lesson?

2. Do you always feel prepared to give your lessons, or do you sometimes feel uncertain about the lesson you are going to give? If you always feel prepared, what makes you feel prepared?

3. If you are sometimes uncertain, what makes you feel uncertain?

4. What is your opinion about the lesson plans?

5. Once you have been trained in a lesson, you fetch your learner groups and start with your lesson. What then helps you to teach the lesson you have just learned?

6. What do other tutors mean to you in your program?

7. The program makes us all happy, and we are having a great time. Why?

8. How would you describe the 'vibe' in the program?

9. Do you feel you have a say in the decisions taken in the program? Why?

10. How would you describe the discipline in the tutor programme?

11. How would the tutor programme influence you about mathematics when you are a parent one day?

12. You learned a lot about mathematics in the tutor programme. How and when did you learn this?

13. You learned how to face many challenges during your lessons. How did you learn how to deal with these challenges?

14. Do you think the tutor program prepares you for a job one day? This could be any job, not only teaching. Explain why you say "Yes" or "No". You can give more than three, but not less than three.

15. How did the tutor program change your mathematical knowledge? Name five ideas/beliefs/perceptions/understandings that you had about mathematics in school, that the tutor program changed and explain how it changed.