Towards a conceptual framework for integrating African immigrant learners learning mathematics word problems into South African high schools.

By

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DECLARATION

I, **Ernest Mahofa**, hereby declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed **Date**

ABSTRACT

This qualitative study relates and examines the experiences of African immigrant learners while learning mathematics word problems in the Further Education and Training phase at two South African schools in the Western Cape. Purposefully selected participants' narratives were collected by means of classroom observations and semi-structured interviews. A range of data sources and data collection methods increased the credibility, trustworthiness and dependability of the research. The sample consisted of 8 teachers and 14 African immigrant learners from a target population of 84 teachers and 2197 learners. Phenomenological data analysis strategy was used for analysing the recorded experiences. The findings revealed that African immigrant learners faced multiple challenges arising from the language of learning and teaching, mathematics academic language, exposure to different teaching methods and a new education system, use of code switching by teachers, discrimination, isolation, technology use and limited/non-use of learners' funds of knowledge. It was found that teachers lacked mathematics pedagogical skills and mathematics content knowledge, social relations, and expertise in teaching diverse learners. However, it was noted that some teachers were supportive, helpful, and keen to work with African immigrant learners: some classes promoted a welcoming environment for them. From the findings, an Integrated Transitional Intervention conceptual framework was developed for use by teachers involved with these learners and those in similar situations. This framework aimed to assist immigrants to transition smoothly in their new learning and teaching environment. The framework promoted an awareness amongst teachers of ways to integrate immigrant learners into the South African mathematics classroom. The development of the conceptual framework contributed to the mathematics body of knowledge. The findings of this study recommended that teachers (i) reduce the use of code switching to a learning resource only, (ii) recognise and exploit learners' previous knowledge as funds of knowledge, (iii) minimise discrimination in the learning and teaching process, (iv) deploy technology in the teaching and learning of mathematics word problems, (v) establish clear definitions of mathematical terminology and (vi) learners should be put into mixed language groupings for better learner understanding.

DEDICATION

I dedicate this:

- To my family for their selfless emotional support, encouragement and sacrifice in my life; they are "*The fountain of inspiration"* in my life journey.
- Special dedication to my mother, Raina Mahofa, late father, Asa Cleophas Mahofa and my siblings for their sacrifice to educate me from my childhood.
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ABBREVIATIONS AND ACRONYMS

ABBREVIATION/ACRONYM	EXPLANATION
AILs	African Immigrant Learners
ANC	African National Congress
APA	American Psychological Association
ARESTA	Agency for Refugee Education, Skills Training and Advocacy.
BICS	Basic Interpersonal Communication Skills.
CALP	Cognitive Academic Language Proficiency.
CPUT	Cape Peninsula University of Technology
CS	Code Switching
DoE	Department of Education
DHA	Department of Home Affairs
DRC	Democratic Republic of Congo.
EELC	Equal Education Law Centre
ELL	English Language Learners.
ESL	English as Second Language teacher
FET	Further Education and Training
GET	General Education and Training
HOD	Head of Department
ICT	Information and Communication Technology
LiEP	Language in Education Policy
LoLT	Language of Learning and Teaching,
MWPs	Mathematics Word Problems
MKO	More Knowledgeable Others
NCTM	National Council of Teachers of Mathematics.
SA	South Africa.
SADC	Southern African Development Community
SMT	School Management Team
USA	United States of America

CHAPTER 1
INTRODUCTION TO RESEARCH

1.1. Introduction

This study explored the experiences of African immigrant learners (AILs) learning mathematics word problems (MWPs). The study was prompted by the wish to contribute to the knowledge of experiences of AILs in South African schools so that their voices may be heard. From the study, it became evident that AILs were faced with multiple, distinct challenges in learning MWPs: use of the Language of learning and teaching (LoLT), mathematics academic language, learner-teacher interactions, teachers' use of code switching (CS), mathematics teacher's professionalism (teacher's mathematics content and pedagogical skills), discrimination and isolation, lack of care and belonging, technology use and use of learners' funds of knowledge.

This chapter discusses the background of the research problem, states the research problem and research questions and sets out the purpose of the study and its significance. This is followed by a summary of chapters and the limitations of the study.

1.2. Origin and background of the study

Since the end of apartheid in 1994, there has been an influx of immigrants into South Africa (SA) from many countries north of its borders. The African National Congress (ANC) in 1994 changed national policy to permit this immigration, as a way of (i) repaying countries which had granted sanctuary to liberationist organisations during the struggle for independence, and of (ii) honouring its commitment to human rights. Mandated changes were recorded in parliamentary statutes as required by South Africa's new constitution No.108 of 1996 (Department of Home Affairs (DHA), 2017). The new (South African) government claimed to promote human rights as well as international cooperation with African countries. Klotz (2013:193) noted that "the constitution of South Africa (1996) applied to 'all people' who live in it". The DHA (2017:9-10) averred that:

> *From 1994, the vision of South Africa's first democratic government was to reverse racially-based and exploitative laws, and integrate South Africa into the SADC region, the African continent and the world. The transition to democracy has enabled South Africa to play a full and active role in the family of nations. This is one of the fruits of a struggle in which the mobilisation of international support played a critical role.*

This influx of immigrants from further north such as DRC, Tanzania, Somalia and Zimbabwe has (i) resulted in a high demand for educational services and (ii) tested the promises made to those countries that had protected struggle fighters. The number of AILs is increasing steadily in South African schools (Suriel, 2014): these learners have varying levels of proficiency in the prescribed LoLT. Yet few teachers are able to address immigrant learners in their home LoLT such as French, thus presenting a major difficulty for the education system. South African schools have no history of teaching AILs on such a scale and are suddenly confronted with a substantial demand to provide quality education to learners who are linguistically and culturally diverse (Department of Basic Education, 2010; Brand & Glasson, 2014). Few South African teachers are adequately prepared for such diversity and have little or no experience of working with AILs (Deussen, Autio, Miller, Lockwood & Stewart, 2008). Catalano, Fox and Vandeyar (2016) claimed that the dramatic increase in the number of immigrants in South African schools presents great challenges to teachers in the learning and teaching environment. In the subject of mathematics, in particular, immigrant learners find it intimidating to execute MWPs tasks (Webb, 2015). This area is the focus of my study.

1.3. Statement of research problem

Some immigrant learners are drawn from countries such as the Democratic Republic of Congo (DRC) where they had learned all their mathematics in French, which creates a difficulty when learning MWPs expressed in English as the LoLT in South African schools. African immigrant learners find themselves in a new learning and teaching environment and new educational system; markedly different in philosophy from the one in their country of origin (Vandeyar, Vandeyar & Elufisan, 2014). The learning and teaching of MWPs in a language that is not the same as the learners are used to place additional and intricate demands on teachers and AILs alike (Latu, 2005; Suarez-Orozco, Pimentel & Martins, 2009).

Mirici, Galleano and Torres (2013) argued that teachers need to have a better understanding of the distinctive needs of immigrant learners; seeing that these learners have varying levels of English proficiency. As the number of immigrant learners grows, they tend to experience learning in a range of distinctive ways in SA (Awokoya & Clark, 2008; Vandeyar, 2010; Vandeyar & Vandeyar, 2012; Vandeyar, 2013). Many challenges result from inadequate education policy in terms of the teaching of immigrant learners. There is a disconnection between the hospitable legislation of government and the lack of the infrastructural facilities and mathematically qualified teachers to honour the government's constitutional and humanitarian promises.

Little research has been done on the learning experiences of AILs in MWPs at the FET phase in South Africa. Kornhaber, Wilson, Abu-Qamar and Mclean (2014) reported that within the immigration literature, there is little exploration of the lived experiences of learners in the teaching and learning process. Previous studies provide valuable insight and knowledge concerning how immigrant learners experience their lives after arriving in new countries, but little is known specially about African immigrant learners' experiences in the learning of MWPs in a South African context. Vandeyar and Vandeyar (2012), Sofo, Nadzo, Asola and Ajongbah (2013) as well as Kornhaber et al. (2014) all agree that few studies have so far reported upon the lived experiences of immigrant learners in the learning and teaching context of SA. The current study then identified its main question as: '*How do African immigrant learners experience the learning of mathematics word problems in the Further Education and Training Phase in the Western Cape Province?'*

1.4. Background to the research problem

Kent (2007) remarked that in the United States of America (USA) the majority of immigrants seek educational opportunities as a first priority. Ramphele (1999) noted that many immigrants to countries such as SA are primarily motivated to gain new and enriching educational experiences. In their search for educational advancement, AILs often encounter obstacles in learning MWPs because English is to them a foreign language. Little attention is paid to how these learners experience the learning of MWPs when using a LoLT that is different from the one they used in their countries of origin. In the USA, some teachers are professionally certificated either as English Second Language teachers (ESL) or in bilingual education (Gandara, Maxwell-Jolly & Driscoll, 2005). This contrasts with the situation in SA. Many teachers in this study were not equipped to cater for the needs of AILs learning MWPs.

Immigrant learners have been routinely marginalized in terms of the challenges concerning their learning experiences in schools (Diego, 2014). In exploring the lived experiences of AILs learning MWPs, the current study sought deeper insight in terms of the narratives, experiences, perceptions, and challenges associated with these participating learners.

According to Hemson (2011), AILs make a valuable contribution to South African education. Kent (2007) pointed out that immigrant learners bring a variety of abilities and experiences that are useful in the learning of mathematics. Rich mathematical cultures and customs brought by immigrant learners may be shared and adapted by South African learners for their own

academic benefit in the learning of MWPs. There is little South African literature that documents the particular issues that immigrant learners come across in their education (Brown, Miller & Mitchell, 2006). Therefore, the study was conducted (i) to understand the experiences of AILs learning MWPs and (ii) to develop policies and methods that could meet the educational needs of AILs learning MWPs. (iii) develop a framework for integrating immigrant learners into the South African mathematics classroom in respect of facilitating problem-solving. (iv) develop programmes that could assist teachers of AILs to be well-equipped to support these learners.

1.5. Purpose and significance of the study

Little research has been undertaken either nationally or internationally into the experiences and learning strategies of immigrant learners (Suarez-Orozco, Pimentel & Martin, 2009). No research is known to have focused specifically on the experiences of AILs when learning MWPs in South Africa.

The mathematics classrooms in so-called township schools[1]in SA are multi-lingual (Essien, 2010); local and AILs have an assortment of home languages, generally dissimilar from the medium of learning and that of their teacher's home language. Little is known about the daily experiences of AILs in South African schools because few studies have been conducted (Suarez-Orozco et al., 2009; Vandeyar, 2010). This study focused upon a sub-group which sheds light on comprehensive learning issues occurring internationally as well as in the African context. In so doing it raises awareness about a mounting, if poorly understood and neglected, group of learners in South African schools.

Effective integration of AILs into the learning and teaching environment of SA may be of benefit to South African learners and the country as a whole. According to Adams (2012), meaningful learning takes place when learners' views are taken into consideration. In this study, African immigrant learners' voices were heard; so that they can be afforded the same educational opportunities as local learners. The purpose of this study was to increase awareness of the plight of AILs who are often marginalised, stigmatised, discriminated and excluded in the South African education system. South Africa (2011:4) stated that: "South African Schools

[1]Although segregation and the Group Areas Act that enforced geographical separation of white and non-white habitation have been removed, it is common for all communities to retain the vocabulary of privilege by calling previously whites only residential areas 'suburbs' while calling previously non-white areas as 'townships'. This thesis in no way endorses the perpetuation of such degrading nomenclature but merely uses the received parlance for identification purposes.

Act 27 of 1996 amended that (i) every learner is to be instructed in the language of his or her choice where this is reasonably practicable and enabling the education system to contribute to the full personal development of each learner, and (ii) to the nation at large, including the advancement of democracy, human rights and the peaceful resolution of disputes". The findings offer benefits to the South African education system; possibly affecting immigrant learners in other spheres of education. Therefore, to promote the smooth running of schools nationally, teachers and policy makers need to know about the common experiences of immigrant learners.

This study aimed to assist policy makers and teachers develop new strategies to use when teaching MWPs; so as to support AILs as well as South African learners. This development of new strategies enables both local and immigrant learning communities to realize the potential for richer interaction (Cesar & Favilli, 2005). By using phenomenological approach in this study, teachers were offered insights to inform their practice and empower them to develop their teaching of mathematics (professional development). Mathematical cultures and customs brought by AILs may be shared and modified by South African learners for their own academic benefits in the learning of MWPs.

The phenomenological approach used in this study aimed to develop the theoretical understanding and educational practices of teachers, AILs and local learners in the teaching and learning of MWPs. By carefully listening, observing and interpreting the lived experiences of participating learners' learning of MWPs, as a researcher, I aimed for greater insight and understanding about whether the needs of such learners were met or not. The representations that both local South African learners and AILs entertain about each other are essential for building mutual understanding and constructive collaboration (Planas & Civil, 2008). Understanding the nature of participants' learning experiences, and the meaning they make from these experiences can assist mathematics teachers, schools and the Department of Education (DoE), towards the goal of providing learning environments that are linguistically and culturally inclusive for learners.

The research study led to the development of an Integrated Transitional Intervention (ITI) conceptual framework to assist teachers and AILs when learning through MWPs, by reducing the challenges faced by these learners. The framework was developed to provide an understanding and an awareness by teachers of immigrant learners that would enable them to integrate these learners into the South African mathematics classroom and facilitate problem-solving.

1.6. Contribution of the study

This study aimed to bring the following benefits:

Deepening of teachers' experiences and knowledge about the learning experiences of AILs in South African schools.

- Providing deeper insight into the needs of AILs and newly arrived learners in schools.
- Providing deeper insight into the lived experiences of AILs when learning MWPs.
- Providing intervention programmes on how to cater for the challenges faced by AILs.
- Deepening the theory and practical knowledge on the experiences of AILs in the South African education system.
- Providing information that can improve teachers' professional development to be well prepared to meet diverse learners' learning needs.
- Providing an opportunity for marginalised learners' voices to be heard so that the stakeholders may take appropriate action for example, change or amending policies, strategies, intervention programmes or formulation of policies for immigrant learners.

I also contributed to the mathematics education body of knowledge by publication of an article in a Department of Higher Education and Training accredited journal ***[African Journal of Research in Mathematics, Science and Technology Education,* 22, (1): 27-36] the title: *"Exploring the learning of Mathematics word problems by African immigrant early learners".***

1.7. Research question

The main research question guiding this study was: *How do African immigrant learners experience the learning of mathematics word problems in the Further Education and Training phase in the Western Cape Province?*

1.7.1. Sub-questions

From the above main research question, the following four sub-questions were derived:

- How do African immigrant learners experience what they learn in mathematics word problems?
- How do African immigrant learners integrate their past experiences into the learning of mathematics word problems in terms of their relations with teachers and other learners?

- What are teachers' views about African immigrant learners' experiences in the learning of mathematics word problems?
- What framework can be used for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?

1.8. Summary of the phenomenological theoretical framework

A phenomenological theoretical framework underpinned this study. Phenomenology as a recognised discipline was founded by Edmund Husserl (1859-1938) and further developed by Martin Heidegger (1889-1976), Merleau-Ponty and other theorists. Giorgi (1989) and Van Manen (1990) explained that phenomenological research addresses the issue of how people live or how they conduct themselves and experience circumstances. Phenomenology deals with the actual human beings' experiences in their usual state; to be exact, "it goes back to things themselves" (Husserl, 1962).

1.9. Summary of the research methodology

The qualitative phenomenological research methodology adopted in this study was embedded in an interpretive paradigm. Phenomenological research methodology was employed since it promotes the use of both semi-structured interviews and classroom observations. This methodology allowed an exploration and deeper understanding of the lived experiences of AILs in the learning of MWPs from their own unique perspective.

1.10. Structure of the thesis

The thesis comprises of seven chapters whose contents are summarised below.

1.10.1. Chapter One

The chapter comprises the background, problem statement, purpose and aim of the study, and research questions as well as summaries of the theoretical framework and research methodology.

1.10.2. Chapter Two

This section discusses the theories used as background for explicating the lived experiences of learners in the learning of MWPs. In the literature review, the phenomenological framework for studying the experiences of AILs in the learning of MWPs is reviewed in greater detail.

1.10.3. Chapter Three

This chapter describes the research paradigm, research methodology, and research design used in the study. The data collection methods, purposeful selection method, credibility and dependability are discussed in more detail. This is followed by discussion of the role of the researcher, ethical considerations, and an explanation of how the data was explicated to provide answers to the research questions.

1.10.4. Chapter Four

This chapter reports on how data from semi-structured interviews and classroom observations were analysed. Transcriptions of semi-structured interviews and results of classroom observations are presented for analysis. This chapter discusses the findings and data analysis. The results of the collected data are presented and discussed at length. Colaizzi's (1978) phenomenological data analysis strategy was used to make meaning of participants' experiences in learning mathematics word problems.

1.10.5. Chapter Five

This chapter discusses the findings in detail. Data are analysed and linked to the literature review.

1.10.6. Chapter Six

This discusses the summary of the study and the development of the ITI conceptual framework for integrating immigrant learners into the South African mathematics classroom in order to facilitate problem-solving.

1.10.7. Chapter Seven

This chapter offers a conclusion and recommendations for further study of the experiences of AILs learning MWPs.

1.11. Limitations of the study

The cultural diversity of African immigrant participants may have hindered some from expressing themselves in English and have inhibited communication and meaning for both the participants and myself. I focused on AILs in one part of the Western Cape Province in SA only so the findings might not be generalized to provinces with different demographics and political establishments. The sample was small and drew upon particular types of AILs: for example, a Somali speaking learner who participated in the study could not be assumed to be representative

of all AILs learning MWPs in English in a new country. The study did not represent quantitative findings as it was a qualitative research. Also, the time for the study was short and so precluded longitudinal findings.

Further research is needed to confirm the findings of this study; both with larger groups of participants and in other locations. The phenomenological approach adopted is not generalizable (Van Manen, 1997; Wilson, 2015). Despite the above limitations, it remains a worthwhile method for achieving an understanding of lived experiences, which is particularly valuable in mathematics education related studies.

1.12. Chapter summary

This chapter introduced the study, the research statement, background of the research problem, purpose of the study and its significance, research questions, the summary of the theoretical framework and the research methodology. It also outlined the structure of the study by summarising each chapter. The next chapter discusses the phenomenological theoretical framework and presents a literature review on the experiences of AILs in the learning of MWPs.

CHAPTER 2
THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Introduction

The previous chapter discussed the background to the research problem, the purpose and significance of the study. Chapter two sets out elements of the phenomenological theoretical framework underpinning the study and reviews extant literature that is germane to the lived experiences of AILs learning MWPs.

2.2. Theoretical framework

2.2.1. Phenomenology

Phenomenology is relevant to the complex issues addressed in this research investigation. The particular phenomenological theoretical framework generated this study demarcates and defines relevant aspects of how people live; how individual participants in this study behaved and experienced the circumstances in which they found themselves (Giorgi, 1997). Phenomenology informed an exploration of the realities of life as they existed for the participants; as they were manifested, perceived, recalled and represented by a specific group of learners carefully selected for a specific socio-linguistic purpose (Giorgi, 1999). Makoe (2008) propounded that the connotation of a phenomenon, in this case learning MWPs, can be discovered in its completeness through a phenomenological study which exposes the lived experiences of individuals.

Phenomenology, as a recognised philosophical discipline, was initially developed by Edmund Husserl (1859-1938). It was later refined in its parameters and applications by major 20th century thinkers including Martin Heidegger (1889-1976), Maurice Merleau-Ponty (1908-1961), Ricoeur and Jean-Paul Sartre (1905-1980) and others, to focus sustained and reliable attention upon the details, conditions and inner reflections of the lived experiences of a specific group of human beings (Spiegelberg, 1982; Harman, 2007). These theorists reached an academic accord: that the concerns of phenomenology should be consciousness, human existence and the very nature of being itself (Giorgi, 1997). Husserl (1962) explained that phenomenology is the study of human consciousness: the essential rules of experience as found in consciousness. Phenomenology describes "structures of experience as they present themselves to consciousness and also tries to understand the human experience through explicating or analysing participants' descriptions of their experiences" (Van Manen, 1990:56). Phenomenological endeavours render intuition into reality and bring humans closer to the

perceived living world (Van Manen, 1990). Lester (1999) asserted that phenomenology is concerned with the study of experiences from the individual's viewpoint. Finlay (2009) entrenched this attitude in emphasising that phenomenology attends to intricate and rich descriptions of everyday life. Phenomenology 'goes back to the things themselves' (Heidegger, 1962; Husserl, 1962; Kruger, 1988; Moran, 2000; Harman, 2007). Kakkari (2009:20) reminded us that Husserl's fundamental dedication to "the things themselves" implies an approach that is free or at least freed as far as possible from conceptual presuppositions.

Phenomenology is a philosophy concerned with exploring and understanding human experiences; it is able to generate a theoretical framework which assumes that human behaviour is determined by the experiences gained out of an individual's direct interaction with certain phenomena of existence (Giorgi, 2005). During interaction with various phenomena, individuals interpret experiences and attach meanings to different actions and interactions: constructing new experiences in the course of interaction with the ambient factors of living (Langdridge, 2007). These definitions suggest that phenomenology is a study of the experiences of certain selected individuals which creates a sense or representation of the phenomena of their circumambient lives in a comprehensive sense. A phenomenologically based research project predicates acceptance of evidence that is presented by human beings who live in the world of experiences and register their awareness. Phenomenology as an applied philosophy in the social sciences offers a rich source of concepts for examining and understanding the lived experiences of immigrants who wish to learn MWPs.

Phenomenology emphasises the lived experiences of human beings and how these human beings, African continental immigrant learners in the case of this project, make sense of, or try to apprehend, the challenges, successes and adjustments of a new and challenging socio-economic environment (Mahofa, Adendorff & Kwenda 2017). The focus of this study was upon the phenomenologically ascertained, lived experiences of participants. Smith, Flower and Larkin (2012:11) considered phenomenology to be a philosophy that concerns itself with the inward experience of a human being; the utter essence of an entity; separate from its being. Connell (2003:34) agreed that "phenomenology focuses on procuring the truth of inward experience; the evidential proof presented by the individual consciousness".

Shrestha (2011:89) stressed that "lived meaning" denoted the way in which individuals experience and understand their world as existing and meaningful. Lived meanings in the context of this prescribed investigation denote facets of the learning of MWPs as experienced

by African immigrants (Gorgorio & Planas, 2001). Luitel (2013:102) proposed that "phenomenological philosophy aims to elucidate the individual lived experiences; at its heart is the notion that each person's perceptions will be shaped by that person's own engagement with reality, based upon their previous experiences and ways of viewing the world". Phenomenology focuses on the detection and interpretation of the inner essence of participants' day-to-day common learning experiences; the participants' perceptions of the event or situation which in this case comprised the learning of MWPs. Phenomenology was used in this study as the basis for a theoretical framework because the researcher was concerned with, and interested in:

- How AILs describe and interpret their experiences in the learning of MWPs.
- How AILs construct their worlds when learning MWPs
- What meanings AILs attribute to their experiences in the learning of MWPs
- What teachers' views are about African immigrant learners' experiences in the learning of MWPs

This study focused upon descriptive phenomenological research as stated by Husserl (1962) where bracketing denotes the suspension of the researchers' prior beliefs to promote objectivity in the research process. Husserl's search for truth about humans focused on both the theoretical and philosophical aspects of human's experiences with the emphasis on bracketing and essences. Heidegger (1962) disagreed with this proposition and supported the idea of including the researcher's own experiences in the interpretation of participants' experiences. Husserl and Heidegger both used lived experiences to clarify and verified how human beings experience certain phenomena through observation and interaction; to develop unquestionable meanings about the truth of human living. Reiners (2012) claimed that in a phenomenological study, knowledge can be gained by registering precisely the interactions that occur between researchers and participants. Wilson (2015) held that an interpretive approach towards lived experiences asserted that people and their world were inseparable: the researcher could legitimately draw upon research participants' own life experiences to interpret the experiences of participants. Phenomenology is not only a description but an interpretive process as well, since the researcher interprets the meanings of the participants' lived experiences (Van Manen, 1990; Creswell, 2013; Rocha, 2016).

Phenomenology provided an overarching framework for this study of the lived experiences of AILs in the learning of MWPs. Such experiences occur in the fluctuating, dynamic and evolving

context of the mathematics classroom; with the key elements being the teacher, AILs and local South African learners.

2.3. Literature review

An extensive review of international and local literature was undertaken about lived experiences, LoLT usage in learning of MWPs and immigrant learners' mathematics performance. In addition, extant information was reviewed on mathematics knowledge of immigrant learners, teaching and learning approaches, and cultural beliefs in the learning of MWPs, parent involvement and strategies to cater for participants' learning needs.

Many people have migrated to different parts of the world for a variety of reasons including educational opportunities. Kent (2007) noted that in the USA, immigration had resulted in a large number of immigrant learners in schools. In SA, immigrants bring their children who find themselves in the South African education system, which may be similar or vastly different from that in their country of origin. Although the teaching of immigrant learners has become a major concern in South African schools, Kornhaber et al. (2014) pointed out that there is a dearth of literature that explores lived experiences of AILs in the South African learning context. No studies have specifically explored African immigrant learners' lived experiences in the learning of mathematics word problems in a South African context.

2.3.1. Learners' lived experiences

Van Manen (2007:16) defined lived experience as "simply experience-as-we-live through-it in our actions, relations and situations". Burch (1990:134) noted that "the meaning of one's experience is essentially something constituted; it lies in what is made of what is lived through". Similarly, Shrestha (2011) defined lived experience as a type of remembered experience. Lived experiences mean existing experience or previous knowledge or past know-how that has been gained over time. The purpose of using the term 'lived experiences' is to make sense of experiences from the point of view of the person who has the experiences. To use the term 'lived experience' is to make sense of the experiences of individuals from their point of view (Van Manen, 1997). Lived experiences provide a platform to gain greater insight into the silent voices of consciousness and meaning of human existence; in this case, understanding of the day-to-day lives of participants in their mathematics classroom.

Following the perspectives of Van Manen (1990), the experiences of AILs in the learning of MWPs were described according to: first, the lived space which is the classroom environment

in which the learning takes place, being the learning and teaching resources such as technological facilities, textbooks in the classroom and the seating arrangement of learners (Mahofa et al., 2017). Second, these experiences were analysed in terms of the selfhood, self-worth, self-concept or self-esteem that comprise an individual's self or the personal meanings of the lived experiences of the body that the AILs communicate with, and by which they come to know and understand their new world; so as to grow self-confidence in doing their school work (Makoe, 2008). Third, experiences of African immigrants were related to the lived times, which are the past learning experiences of AILs and how these may affect their present and future learning experiences in a new learning situation. Fourth, experiences were placed in the context of the lived social relations, that is through intersubjectivity, interaction with others, experience, connection with others that the AILs gain an understanding of the social world around them (Grunwald & Thiersh, 2009). The experiences of the participant AILs in conversation while learning mathematics through word problems may be influenced by their parents, teachers, and other learners apart from other factors discussed above.

Parents, teachers and other learners may influence how AILs relate to and adapt to the new learning environment (Abebanji, Phatudi & Hartell, 2014). The lived social relations involve the experiences of the relations between AILs, teachers, immigrant learners and local learners as well as their interaction or communication during the learning of MWPs (Makoe, 2008). Koopman (2015) extended this perspective by stating that individuals learn to construct their understanding of the world through interactions with the environment and other individuals. Lave and Wenger (1991) pointed out that members of the community of practice participate and interact with each other by living in the world when they experience the process of comprehending the world in which they live.

Lived experiences can be viewed as interactions between a learner and what is to be learnt; in this case mathematics learned through word problems. Lived experiences are the contemporary skills developed within an individual. Lived experiences could include previous mathematical skills gained by participating learners from their home countries or the skills and knowledge that these learners bring to the mathematics classroom and how these intellectual attributes are integrated or incorporated into the present teaching and learning environment. Lived experiences provide direct impression of an individual's discrete life; a moment in the set of occurrences that make up an individual's life (Van Manen, 1990). Consequently, lived experience includes what AILs in FET phase experiences while learning MWPs. Vandeyar and Vandeyar (2012) pointed out that immigrant learners have academic and social experiences

within and outside the classroom. Each learner experiences a unique amalgam of language use, teaching methodologies, interaction with teachers and peers' experiences in the learning process. Individual learners' experiences constitute the lived space, body, time, and social relations (Van Manen, 1990; Shrestha, 2011). I adopted the perspective that: "the basis of lived experiences is action that brings together the person, context and ideas: individuals may experience the same phenomenon differently and lived experiences of individuals can be influenced by various visible and invisible structures surrounding the context of the individual" (Luitel, 2013:102). Although the focus was on individual experiences of inter-subjectivity, collective forms of subjectivity, such as ethnicity, culture and religion, shape how relations with others are played out and experienced (Grunwald & Thiersh, 2009). Lived experiences in this study directly refer to what participants in the FET phase understand and feel while learning MWPs.

2.3.2. Mathematics word problems explained

The present emphasis on MWPs is relevant in that the South African curriculum "highlights problem-solving in mathematics as a discipline and the application of mathematics in the real-world situations" (DoE, 2003:9). The skill of dealing with problem-solving is an essential facet of mathematics learning for learners. There is, however, a need for LoLT proficiency. According to Clements and Sarama (2009), mathematics classrooms are usually associated with solving problems and mathematics reasoning where LoLT is useful for communication of mathematics concepts. Barwell (2018) found that language of instruction formed an obstacle to the academic success of mathematics learners. The South African mathematics classroom consists of diverse learners from different nations and cultures; including African immigrants who are drawn from different education systems. Mathematics content that involves word problems is a challenge to learners because many mathematics classes are becoming multilingual (Barwell, 2005; Barwell, 2018). The learning of MWPs may possibly be a much greater obstacle to immigrant learners than to South African learners.

Irujo (2007:325) stated that "Mathematics word problems involve critical thinking and problem- solving techniques". Charles (2015:1) confirmed that

> *a mathematical word problem is a real-world context in which mathematical quantities are given, values of one or more quantities are known, values of one or more quantities are unknown, relations between or among quantities are described, a question is implied or stated asking one to find the value of one or more unknown quantities and one or more of the operations addition, subtraction,*

multiplication and division can be used to find the value of the unknown quantity or quantities and answer the question.

Sajadi, Amiripour & Rostamy-Malkhalieh (2013:2) considered MWPs as "a more unique and challenging task than the ordinary mathematical task as it is a 'cognitive activity' that involves processes and strategies".

According to Vandeyar and Vandeyar (2012), language is an important contributing factor in immigrant learners being accepted into a new society. If immigrant learners are not able to communicate in the language of the host country, they will in all likelihood be excluded from the learning environment that is the mathematics classroom (Mahofa et al., 2017). Similarly, Taylor and Doherty (2005) argued that immigrant learners who are new to their host nation, particularly those who cannot communicate with local learners because of the language barrier, experience interaction problems in the classroom, sport activities and in the community. According to Vandeyar and Vandeyar (2012), when African immigrants enter South African schools, teachers see and treat them the same as the black South African learners without taking into consideration that the immigrant learners cannot readily use the LoLT for their learning of mathematics. Awonkoya and Clark (2008) found that black immigrant learners in USA were often mistakenly perceived by teachers as unintelligent or academically incompetent because of their ethnicity and low proficiency in the prescribed LoLT. Extending this point about assumptions, Wright (2010) advised that even when teachers understand or know their learners' cultural background or ethnicity, they should evade stereotyping and generalising since each learner is unique.

The factors mentioned above suggest that immigrant learners tend to be ignored during the learning process. Gorgorio and de Abreu (2009) mentioned that teachers had problems in communicating with immigrant learners because immigrant learners had difficulties with the LoLT. This point corroborated the findings of Cummins, Bismilla, Chow, Cohen, Giampapa, Leon, Sandhu and Sastri (2005), who showed that because immigrant learners' prior knowledge is embedded in their home language, it becomes difficult for immigrant learners to retrieve the assumed mathematics knowledge when it is taught in another language (LoLT). Jhagroo (2011) agreed that problem-solving in mathematics needs proficiency in the home language for learners to be able to explain their reasoning effectively.

Wilbourne, Marinak and Strickland (2011) noted that immigrant learners experience elevated levels of anxiety when unfamiliar vocabulary or unreal-life situations were used by teachers in MWPs. Learners might experience difficulties with MWPs due to the use of unfamiliar mathematics terminology (Holtman, Julie, Mbekwa, Mtetwa & Ngcobo, 2011). Immigrant learners are challenged by the acquisition of LoLT, the learning of MWPs, trying to adjust to the new school environment as well as gaining mathematics skills, vocabulary, and new terminology. The language used by South African teachers will often (but not necessarily in all cases) be more familiar to local South African learners than to immigrant learners who have a different cultures and are not fluent in English; or in local South African languages; causing confusion in immigrant learners (DoE, 1996). Gorgorio and de Abreu (2009) mooted the idea that immigrant learners' lack of fluency in mathematics and the LoLT created an obstacle to their learning process. They went on to say that if learners' language competence is poor then it will affect the learning process itself, since language is used for the facilitation of the integration process.

Immigrant learners who arrive with little or no LoLT instruction need to be assisted with proper LoLT development if they are to keep up with local learners. Teachers could try to use additional approaches so that learners develop LoLT literacy more rapidly while promoting understanding of the subject content. In agreement, Lavadenz (2011) and Cummins, Mira and Stille (2012) reported that using learners' home language as support could be crucial for providing an additive as against a subtractive approach for the acquisition and efficient use of a second language as LoLT. DoE (2014:8) stated that:

> *Language is a tool for conceptualising content and knowledge, and expressing oneself accordingly in a rational, "academic" style, based on subject-specific conventions and registers. In every institution of learning, the language of learning and teaching (LoLT) should be developed, not only by the English teacher, but by all teachers, while disseminating knowledge.*

It should be widely recognised that language plays a crucial role in communicating and developing mathematics education, is essential for learning and thinking and that the capability for learners to communicate mathematically is vital to understanding the LoLT in the learning of MWPs (Setati, 2008; Yushau, 2009).

Ballantyne, Sanderman and Levy (2008) reported that words that have different meanings in different contexts can cause misunderstanding for immigrant learners. Mathematics vocabulary

often uses words that have both everyday social meaning as well as meanings that relate closely to mathematics. Consider the following examples: "product" in mathematics is a quantity that is obtained when multiplying quantities together; but in other contexts it may mean an article or substance for sale or a result of a chemical reaction; in Agricultural Sciences and everyday situations the word "root" means a part of a plant that collects water and nutrients from the ground; while in mathematics it means a number when multiplied by itself to give an exact number (*Concise Oxford English Dictionary*, 2014). Learners could be misled by such multiple meanings and misinterpret MWPs, resulting in wrong manipulation or stagnation. In such cases, teachers could help immigrant learners by stating that some words have particular meanings in mathematics and where possible, show them how mathematical meanings relate to everyday meanings.

Teachers could encourage mathematical thinking among learners by connecting mathematics to real-life situations by exposing learners to everyday mathematics word problems that reflect the real world of these learners. Teachers should exercise care when using real-life situations from one context if that context is unfamiliar to immigrant learners from different countries with different languages (LoLT) proficiency abilities (Sofo et al., 2013). As each teacher is positioned within a particular unique classroom, examples should be selected which are appropriate to that context and fit their pedagogical content knowledge to this unique mathematics classroom (Ballantyne et al., 2008). Jhagroo (2011) pointed out that the New Zealand curriculum considers only the needs and backgrounds of local learners and does not explicitly take into account the needs of immigrant learners in the learning and teaching process. This neglect could be the reason why teachers ignore the needs of the diverse learners in their classrooms. Aukerman (2007) argued that some immigrant learners have had previous learning experiences that allow them to acquire mathematics language faster; if their previous LoLT was the same as that used in their adoptive school.

2.3.3. Language in mathematics word problems

Language is vital for communicating with others and is central in learning of MWPs. Ni Riordain, Cohen and Miller-Reilly (2015), stated that language is a channel of communication in a mathematics classroom, providing a tool for teacher-learner and learner-learner interactions and facilitating the transmission of mathematical knowledge. Ni Riordain and O' Donoghue (2009) argued that language is an important component of learning, thinking, understanding and of communicating in the learning of mathematics. When solving MWPs, learners develop particular skills to express themselves clearly, logically, confidently, and effectively when

communicating with others. When learners are taught in a language that is not their home language and new to them, they may nonetheless have positive experiences towards the learning process (Mirici et al., 2013).

The American Psychological Association (APA) (2012) pointed out that learners need more arrival time to reach the answer and to think in two languages (English and mathematics). Kessler, Quinn and Hayes (1998) found that limited ability to communicate in English could have considerable and adverse effects on the learning process of foreign immigrant learners.

Literature referenced below details the need to implement strategies for making mathematics concepts accessible and comprehensible to learners. Immigrant learners face challenges in terms of English language learning and eventual academic success; they find the new education system and language (LoLT) demands daunting (Brown et al., 2006; Suarez-Orozco et al., 2009). Teachers should expose immigrant learners to multiple perspectives that support inclusive learning by drawing on the varied funds of knowledge of all learners (Freire, 1996, Suarez-Orozco et al., 2009). In diverse mathematics classrooms there is a need for an inclusive learning that promotes contributions from all learners, both immigrants and local learners. Mathematics cannot be taught without the use of the specialised mathematical language register; competence in mathematics language facilitates engagement in the learning of MWPs (Deussen et al., 2008).

2.3.4. Mathematics language

The DoE (2011:8) defines Mathematics as:

> *A language that makes use of symbols and notations to describe numerical, geometrical and graphical relationships. Mathematics is experienced as a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. Mathematics is said to develop mental processes that enhance logical and critical thinking, accuracy and problem-solving that will contribute in decision-making.*

According to Ni Riordain (2011), mathematics language is contemplated as a distinct register surrounded by a familiar language. According to the Erickson Institute (2017), mathematics is a language for thinking precisely. Different meanings of mathematical vocabulary in different languages pose a challenge for immigrant learners since these learners employ a new LoLT. Schleppegrell (2007) suggested that mathematical language is critical for learners in the

classroom and that both learners and teachers are compelled to use mathematics language. Ideally, mathematics instruction assists learners to move from everyday language to formal mathematical language. For example, the mathematics register in Irish could be different from that in English or French, with each language adhering to distinctive methods and structures for expressing mathematics meaning. Similarly, Moschkovich, (1998:215) noted that the "mathematics register is a set of meanings that is appropriate to a particular function of language together with the words and structures which express these meanings". Halliday (1978) offered the following contrasts between mathematics and everyday meanings:

Table 2.1

Word	Everyday (social interaction)	Mathematics classroom (discourse)
Set	Set the table	Set of elements
Prime	Prime time or prime rib	Prime number
Odd	This paper is in an odd place	Odd number
Even	This floor is even	An even number

[Adapted from Halliday (1978)]

Such contrasts between everyday and classroom meaning of words could cause confusion when learners deal with MWPs. The term itself may not be new but the language in which it is written. Immigrant learners have to deal with new vocabulary or mathematical terminology as well as the new LoLT in which mathematics is taught (Botes & Mji, 2010; Ni Riordain, 2011). Barton and Barton (2005) pointed out that different meanings of the same word may cause learners to misunderstand mathematics problems; resulting in failure to solve these problems. MWPs may contain complex vocabulary or terminology, such as the following question:

The cube root of one fifth of a number is 2, what is the number?

This could be challenging for an immigrant learner to whom mathematical terms such as, *cube root*, and *one fifth* are relatively new. The difficulty that immigrant learners might have with words such as, 'of', and, 'or', 'either', 'a', 'if', and 'then' are easily overlooked (Barwell, 2008). Barton and Barton (2005) found that learners were not able to discover or try questions in which they encountered mathematical vocabulary or words that they could not understand. Barton and Barton (2005) went on to state that Chinese-speaking learners had not learned any mathematics in English in their learning experience in China. These learners had difficulties understanding the meanings of basic words such as "fraction", "decimal", "equivalence", because the words

were expressed in a language different from these learners' home language. Similarly, Barwell (2008) found that learners had challenges in solving mathematic problems when they possess limited mathematical language skills or knowledge. Barton and Barton (2005) reiterated that Chinese learners lacked appropriate problem-solving techniques that required them to read questions, think, analyse, and manipulate the questions. Comprehension skills are important for learners to make sense of and solve MWPs accurately.

The terms used in mathematics could have meanings totally different from their common daily use (Yushau, 2009). For example, *base, similar, power,* and *odd.* These terms have different meanings when used in mathematics English and ordinary English (Menken, 2013). Sepeng and Madzorera (2014), Powel and Nelson (2017) mentioned that learners are adversely affected by poor knowledge of mathematics vocabulary and mathematical terms or words that have multiple meanings. This disadvantage could prejudice their performance when solving MWPs. Immigrant learners encounter difficulties understanding words which they had previously learned in a different LoLT. The challenge of understanding and using specialised mathematical terminology or words may be greater for immigrant learners who are acquiring both LoLT and mathematics simultaneously.

Immigrant learners could experience considerable difficulties understanding textbooks using a new LoLT. Botes and Mji (2010) agreed that when learners in multilingual mathematics classrooms are taught in a language which is neither their first language nor their previous LoLT, they encounter major challenges. These learners need to learn pertinent mathematical vocabulary and appreciate how mathematical terminology relates to everyday usage (Barwell, 2008). Similarly, Schleppegrell (2007) suggested that both teachers and learners should focus on using mathematics language in MWPs classes. This focus implies that teachers should use instructions that assist learners to move from using ordinary English to mathematical language, procedural to conceptual discourses and informal to formal mathematics language (Luckenbill, 2018).

Learners are easily confused about which procedure(s) to use when faced with MWPs. They may easily fail to recognise why a certain procedure should be used. Learners could end up using any mathematics procedure that comes to mind without thinking critically about the reasons for using it. However, Moschkovich (2007:97) disagreed that "everyday meanings and experiences can also provide resources for understanding mathematical concepts".

2.3.5. Mathematics words with dual or multiple meanings

Many words used in mathematics have different meanings in contexts used beyond the classroom; as alluded to earlier. For example, *volume* could be understood as *the increase or decrease of sound* on a radio; while in mathematics it means *the three dimensional space occupied by matter*. Adams, Thangata and King (2005) stated that learners are faced with challenges in working with mathematics words that have multiple meanings. Meiers (2010) added that mathematical terms consist of words that sound the same, i.e. are homophones.

Table 2.2: Example of mathematical terms and their homophonic partners

Mathematical Term	Homophonic Partner
Arc	Ark
Chord	Cord
Mode	Mowed
Pi	Pie
Plane	Plain
Serial	Cereal
Sine	Sign
Sum	Some

[Adapted from Adams, Thangata and Kings (2005)]

Teachers have the unenviable task of assisting learners to move from everyday language to the subject-specific meanings of mathematical language (Adams et al., 2005). Learners have to become acquainted with, and use, mathematical terminology when teaching mathematics; especially when defining and explaining mathematical concepts (Meiers, 2010). Teachers need to facilitate the development of connections between the mathematical meanings of words and their everyday meanings; particularly for equivocal terms, and homonyms by clearly evaluating learners' ability to use mathematical terminology appropriately (Meiers, 2010). Similarly, teachers could evaluate learners' ability to use mathematical terminology by having learners, read, pronounce, or discuss mathematical terms as they solve problems (Adams et al., 2005).

2.3.6. Mathematics communication

Communication without possessing the required mathematics vocabulary is not possible because language plays a core role in the learning of mathematics (Marji, 2009). Communication is an essential aspect of mathematics classrooms because teachers and learners should exchange information. Gyasi (2013) concurred by noting that teachers' communication

has a direct impact upon learners' attitudes about use of mathematics language that involves the use of mathematics terminology and doing mathematics. Proper mathematical communication between teachers and learners helps in the swift transfer of mathematical language, resulting in better mathematics performance. Teachers are expected to model mathematics communication; enabling learners to communicate effectively in group work, whole class or pair work discussions which are essential elements of mathematics understanding (Gyasi, 2013). Similarly, Moschkovich (2007) asserted that there is a need for learners to be assisted to use mathematical language appropriately in mathematics communication, since some of the words could have common meanings that are different from their mathematical meanings. Appropriate mathematical communication could be instrumental in assisting learners to organise, consolidate and coherently explain their mathematical thinking to their peers and teachers (Lerman, 2014). Mathematics communication is crucial in creating opportunities for teachers and learners to discuss, describe and explain mathematical ideas precisely (National Council of Teachers of Mathematics, 2009).

2.3.7. Informal and formal mathematics languages

Communication involves the use of informal or formal language depending on the context of the discussion. In addition, informal mathematics language is the type of language used by learners in their day-to-day lives when expressing their mathematical understanding. For example, a learner might speak of dividing a loaf of bread into nine halves. This is strictly impossible since half means to divide into two equal parts. Formal mathematics language by contrast, is the type of language involving the standard use of mathematics terminology as developed in formal settings as for example, in schools. In practice, formal and informal mathematics languages are used in schools in both written and spoken forms which could cause misunderstanding in learners if they cannot distinguish one from the other. Word problems such as those cited below could present a challenge for AILs due to the mixture of informal and formal languages. Consider the following mathematics word problems: "*By how much is 5 less than 7*?" The learner could say $5 - 7 = -2$ (wrong) or $7 - 5 = 2$ (Correct). Here the word less (minus sign) could cause confusion to learners. "Gina had ten sweets and ate three. How many sweets were left?" $10 - 3 = 7$. Here the word "left" is ambiguous because, to a foreign speaker, it could mean direction or remaining. This situation applies to millions of South African learners who are required to use English as the LoLT when many teachers cannot use it themselves (DoE, 2010; Lerman, 2014). In the examples provided above, learners who are not fluent in the mathematical language could fail to apply the word "less" to the notation of subtraction. These learners could fall back on their own guessing techniques without identifying

or understanding the mathematical language contained in the question. Learners tend to guess what operation to use in terms of what the question requires (Barwell, 2008; Setati, 2008). Immigrant learners not fluent in the LoLT could encounter problems thorough not knowing what is needed or what the English word "less" may mean. While mathematics language is new to both South African and immigrant learners, local South African learners could be better placed since they have been using the LoLT in learning mathematics as compared to AILs who could be just starting to use English (LoLT). In support of this view the DoE (2014:8) noted that "learners use listening, speaking, reading and writing skills to order and satisfy thoughts and information and learn the language appropriate to the subject".

Mathematical language possesses a diversity of nomenclature that is needed by learners to understand and participate appropriately when learning MWPs. For example, the formulae for perimeter of a rectangle may be written**:**

$$\boldsymbol{P = 2(l + b)\ or\ 2L + 2B\ \ where\ l = length, b = breadth};$$

or may be written

$$\boldsymbol{P = 2(l + w)\ \ where\ l = length, w = width}.$$

Similarly, the area of a triangle could be written:

$$\boldsymbol{A = \frac{1}{2}(b \times h)\ \ where\ b\ and\ h\ are\ the\ base\ and\ height\ of\ triangle\ respectively}.$$

However, $\boldsymbol{b}$ could mean breadth in volume of a cuboid or rectangular prism:

$$\boldsymbol{V = l \times b \times h = lbh\ or\ V = l \times w \times h = lwh, where\ b = breadth, l = length\ and\ h = height\ and\ w = width}.$$

Again, in the Pythagoras theorem it is stated that for a right-angled triangle:

$$\boldsymbol{h^2 = y^2 + x^2\ or\ r^2 = x^2 + y^2\ where\ h = hypotenuse, r = hypotenuse, x\ and\ y\ other\ two\ sides\ or\ adjacent\ and\ opposite\ respectively}.$$

It may be written as:

$$r = radius\ in\ Area\ of\ a\ circle,\ A = \pi r^2.$$

These examples show that the use of formulae could cause confusion when learners deal with MWPs. Moreover, it could cause confusion when studying alone without the assistance of the teacher or the more capable others. Learners need support structures to develop their understanding in the use of the LoLT to enhance learning of MWPs.

2.3.8. Procedural and conceptual discourse

Procedural discourse occurs when learners use a procedure without checking whether it works or not knowing the reason for using it. Learners could use the procedure without any considerations. Alternatively, in conceptual discourse, learners are expected to provide reasons for using a certain algorithm and explain or share ideas about the manipulation of mathematical word problems. Immigrant learners, however, may not be able to interact because of the LoLT barrier and may consequently use procedural discourse without any sharing of ideas or substantiating their mathematical steps. Lessons should be structured in a way that affords opportunities to share information and encourage learners to talk and explore mathematics concepts (Luckenbill, 2018). A sharing of ideas should guide them to think mathematically; helping them to acquire conceptual discourse rather than procedural discourse (Setati, 2008). When teachers promote the use of conceptual discourse, it enhances learners' ability to think outside the box, which is a good element for solving MWPs. Learners need to communicate mathematically and to manage the interaction between ordinary English and academic mathematical language, formal and informal mathematics, procedural and conceptual discourses. Kotsopoulos (2007:302) argued that: "For learners to become proficient in mathematics, learners need to participate in mathematical discussions and conversations in classrooms, this participation, in turn, will assist all teachers to understand better whether learners are making appropriate conceptual connections between words and their mathematical meanings". Barton and Barton (2005) stated that learners tend to focus more on the procedural and approach word problems in tests by trying to recognise a suitable procedure without understanding the subject context.

2.3.9. Immigrant learners' mathematical proficiency

The academic performance of AILs may seem to be congruent to the teaching methods used by previous teachers in their countries of origin as well as that in their new country (Vandeyar & Vandeyar, 2012). The use of good teaching styles or skills as well as good rapport between teachers and immigrant learners whose home language was not the LoLT, may be motivating

and improve learners' understanding (Salinas, Franquiz & Reidel, 2008). In their study of immigrant learners, Sookrah, Gopal and Maharaj (2005) found that teachers were speaking too quickly in English and some were unhelpful in terms of making sure that learners understood the concepts under discussion. Immigrant learners were often excluded from the learning process because of their low proficiency of the English LoLT since they had had their previous education in non-English languages. Vandeyar (2011) found that the continued population growth of immigrant learners in South African schools resulted in immigrant learners experiencing some challenges in schools. These challenges included relations among learners and teachers and barriers in communication using English as a medium of communication in some schools.

Limited language proficiency hinders mathematical reasoning which may result in poor learner performance (Moreira, 2009). Ball (2008) noted that learners' performance is significantly related to teachers' mathematical knowledge. For example, if MWPs are expressed in contexts containing unrealistic situations, learners may find the work no more than a recalcitrant puzzle (Holtman et al., 2011). Moreira (2009) reiterated that teachers need to support immigrant learners in acquisition of the medium of instruction and should undergo specialised training in the teaching of diverse learners. The DoE (2011) has offered no programs on how to teach immigrant learners or how to assist immigrant learners in transitioning into a new learning environment on their arrival in SA. Schools and teachers are left with these challenges of creating and improving the performance of immigrant learners in the acquisition of new language. Gorgorio and de Abreu (2009) found that teachers in countries such as the USA and Canada devoted more time to mathematics teaching for immigrant learners where they had transitional classrooms. For instance, they used approaches like Sheltered Instruction Observation Protocol model so that ELL understand content material better as there is promotion of both language development and content (Kareva & Echevarria, 2013).

Gorgorio and de Abreu (2009) found that the performance of learners in mathematics depended on their ability to communicate in the language of instruction. In a similar manner, Lazarus and Lomofsky (2010) lamented that language proficiency affects learners' performance in mathematics classes because learners tend to perform better when the medium of instruction for mathematics is the same as their language of communication. Moreira (2009) claimed that immigrant learners have problems in understanding mathematics expressed in Portuguese due to their low Portuguese proficiency. Barton and Barton (2005) in their findings regarding Chinese-Mandarin speaking learners, revealed that the general mathematics performance of

those learners was of a low standard and they had no background knowledge assumed by their new teachers: these learners had difficulties in understanding mathematics in English. Others who found that low LoLT proficiency was linked to poor learners' performance in mathematics and that immigrant learners were challenged by having to learn a new LoLT and new mathematics language include (Steen (1990); Secada (1995); Teranishi (2004); Barton & Barton (2005); Barwell (2005); Barwell (2008); Martiniello (2008); Salami (2008); Gorgorio & de Abreu (2009); Marji (2009); Suarez-Orozco et al., (2009); Yushau, (2009); Lazarus & Lomofsky (2010); Wilbourne et al., (2011). There seems then to be near consensus that if learners have limited LoLT proficiency, they are likely to perform poorly in their mathematics. Abedi and Lord (2001) and Setati (2008) disagreed with the idea that proficiency in LoLT could improve mathematics performance, arguing that other factors may contribute to poor learner performance in mathematics. These factors could be teachers' limited mathematics knowledge or lack thereof, and learners' willingness to participate in MWPs.

2.3.10. Mathematical knowledge of immigrant learners

Teachers in receiving countries often perceive learners' mathematical knowledge as insufficient. Doyle (2010) noted that receiving countries may regard the mathematical background of immigrant learners as unimportant for the learning of mathematics. Civil (2008) stated that most educational policies view immigrant learner language and culture as lacking value, rather than using diversity as a learning resource and that teachers and schools should look at the different types of mathematics knowledge that AILs possess and to use this knowledge as a resource for learning. On the face of it, better understanding of the background of mathematical experiences of participants should result in teachers applying better strategies for understanding mathematics.

Teachers need to view immigrant learners' previous learning experiences as a resource for learning instead of viewing it as a hindrance or a source of confusion (Mahofa et al., 2017). Civil (2008) considered that in most schools internationally, the LoLT is most often the language of the society. Many immigrant learners have to learn a new language to express their mathematics knowledge. However, in some cases, it is not only the immigrant learners who are faced with this problem; local learners may have home languages that are different from the prescribed LoLT. In particular, in South African schools, the LoLT is often not the learners' home language or that of teachers.

In Malaysia, learners were seen to code switch in an effort to communicate with peers of the same language; so that they could use their mathematics knowledge to manipulate word problems (Al-Azami, 2008). Cummins (2014) shared similar ideas, suggesting that if learners are given an opportunity to draw on their previous mathematics knowledge, linguistic and cultural resources, they may perform better. Having a different language from the LoLT of mathematics could disadvantage immigrant learners in effectively communicating mathematical concepts freely and confidently (Seah, Atweh, Clarkson & Ellernton, 2008). Roer-Stier and Stier (2007) stressed the importance of LoLT proficiency for immigrant learners; so that they may cope in the learning and teaching of mathematics in their new classroom environments. Immigrant learners may perform more effectively when their previous mathematics knowledge is valued, and when the language of mathematics context matches their LoLT of mathematics learning and teaching. Opportunities should be created to expose all learners to multiple perspectives; specially the marginalised immigrant learners to support inclusive learning environments; where all learners' diverse funds of knowledge could be drawn upon (Barwell, 2008). In their study, Setati and Adler (2001) found that some teachers claimed that they used learners' home language to teach because their learners did not understand the mathematics terms, vocabulary or concepts used in the MWPs. In corroboration, Bernardo and Calleja (2005) and Haag, Heppt, Stanat, Kuhl, and Pant (2013) maintain that learners understand mathematics better when expressed in their more proficient language; which could result in these learners being better mathematics problem solvers.

2.3.11. Recognition of prior learning

Recognition of prior learning refers to realisation that learners already possess knowledge about the content before they are taught new information: learners are not "banks" to be deposited in (Freire, 1996). Teachers should try to provide activities that relate to learners' previous learning experiences. These activities should be designed to allow learners to share their learning experiences, past or present, and mathematics interest, culture to assist learners to integrate facets of their previous learning and daily life to better understand and solve MWPs (Barwell, 2008). Wright (2010) recommended that teachers enquire about learners' prior schooling either in their home countries or in their adoptive country.

Activities used in mathematics lessons need to be relevant from the learners' point of view: different learners may experience the same activity differently (Aukerman, 2007). Learners must be listened to closely and observed carefully, so as to ascertain what prior knowledge they offer to the mathematics classroom. By considering learners' prior learning results in promoting

a swift transition for learners from their previous learning experiences to the current situation (Vygotsky, 1962). Teachers should allow learners opportunities to discuss MWPs and explain their ideas to draw on their prior learning experiences and make sense of the new learning circumstances (Barwell, 2008). In some cases, it may be difficult or impossible to access the previous learner's record from their countries of origin. Teaching should begin from where individual learners are and use strategies to make new learning material sensible and relevant. These are challenges to most teachers in South Africa because they are faced with large classes that are unfavourable teacher-learner ratios where it is impossible for teachers to give learners individual attention.

Generally, teachers should be trained and made aware of the value and acknowledge that learners bring by respecting learners' frames of references. When teachers acknowledge their learners' frame of references that leads them to value resources possessed by learners such as creativity, mathematics skills, mathematics knowledge and mathematics cultures. According to De Jong and Harper (2005:112) "Good teachers understand that learners come to school with a wide range of experiences and background learning". Teachers should build on learners' mathematics background knowledge to promote linkage with the new content being taught. For teachers to elicit learners' previous knowledge, they could use a range of teaching methods that caters for all learners. Nevertheless, if teachers lack cultural and linguistic understanding of learners when selecting appropriate teaching methods, their aim could fail. There is a need for teachers to (i) modify their teaching styles to better suit different learners from different backgrounds, including immigrant learners and (ii) refrain from using the "one size fits all" approach. Teachers may use the K-W-L chart strategy devised by Ogle (1986). Here K stands for what do you know? W- What do you want? And L-What have you learnt? (Ogle, 1986). De Jong and Harper (2005) propounded that effective teachers accommodate learners' differences by knowing their learners' individual mathematics capabilities and challenges, and recognise immigrant learners' strengths in areas where local learners may be weak.

Use of learners' prior knowledge could provide the basis for interpreting new concepts (Freeman, 2009). Teachers of immigrant learners should have a clear understanding of their learners' prior learning experiences (Bonenfant, 2012). Cummins et al. (2012:38) argued that: "When teachers open up the instructional space to connect curriculum to learners' lives, learning experiences and assert their identities, learners' academic engagement increases and performance in English (LoLT) becomes more accomplished". Teachers should be able to make sense of what immigrant learners know and can do at a particular time of their learning process.

The more connections that teachers make to learners' learning experiences and interests, the more they promote the relevance of mathematics to learners' minds and lives (Freeman, 2009; Bonenfant, 2012). It must be acknowledged, however, that the fact that immigrant learners have been exposed to other educational systems in their home countries, may constitute a burden to South African teachers in some ways.

2.3.12. Funds of knowledge

Funds of knowledge refers to the body of knowledge, cultural artefacts, linguistic and cultural resources that learners possess and can share with the school setting which and can be drawn upon as a basis of learning (Lavadenz, 2011). According to Lavadenz (2011:29): "The concept *learner's funds of knowledge* includes the cultural, linguistic, and historical resources that students bring with them to the school setting". Likewise, Perez (2011) pointed out that more focus should be on seeing immigrant learners as investment resources (funds of knowledge) rather than learners who take up resources. Marzano (2004) noted that learners learn new information faster and better when the content is integrated with their funds of previous knowledge. Teachers should consider learners' funds of knowledge as a valuable resource (Wright, 2010). Teachers should recognise and draw upon learners' funds of knowledge as rich resources to assist all learners in learning MWPs. When teachers know their learners' linguistic abilities and their countries of origin, they can incorporate appropriate multicultural education strategies and techniques into their teaching of mathematics word problems (Mahofa et al., 2017). The more the teacher knows about learners' learning experiences, the more they know about the expertise that their learners are likely to possess (Vygotsky, 1962; Freire, 1996; Wright, 2010). By contrast, Dantas (2007) found a disconnection between learners' diverse funds of knowledge and the perception of teachers.

According to Cummins et al. (2012), teachers could gain a more accurate sense of learners' previous knowledge and accomplishments if they actively connected learners' lived (learning) experiences and built upon the funds of knowledge brought by these learners to school. However, teachers should be aware that there is active pressure on immigrant learners to assimilate into a mainstream learning environment and become more like local learners.

2.3.13. Code switching

Code switching (CS) may be defined as "the practice of using more than one language in the course of a single communicative episode" (Moschkovich, 2005:125). Code switching can be exploited as a way of using learners' home languages in conjunction with the LoLT. Code

switching may be used by teachers to assist learners to understand the content under discussion and may be especially useful to the local learners (Mahofa et al., 2017). Navehebrahim and Jamshidi (2013) and Afriani (2020) support the use of CS in classrooms as unavoidable and essential for learner understanding, as a part of the communicative resources in bilingual classes and an active aspect in learners' learning experience. Alternatively, CS in teaching MWPs can become an extra burden for immigrant learners due to their incapacity to communicate in either the home language or the LoLT (Mahofa et al., 2017). Alenezi (2010:10) argued that "code switching is an influential teaching tool that facilitates learning and teaching because it encourages learner involvement in the teaching and learning process". Teachers could use CS in the teaching and learning process for particular reasons.

Jegede (2012) stated that teachers could use CS to:

- Translate concepts from LoLT to learners' home language or vice versa.
- Express the concepts clearly to learners in the language they understand better.
- Check that learners understood concepts taught.
- Allow learners to explain concepts clearly in their home languages.

Bacherman (2007) and Durano (2009) argued that use of CS hinders communication and increases the possibility of misunderstanding due to the use of two languages in classroom conversations and can signify waste of time and effort. If learners are taught by teachers who are not fully conversant with their home languages, the use of CS might be fruitless to them. These learners may be excluded from the learning and teaching process. However, CS may be beneficial if the immigrant learners are taught by teachers who can speak their home language.

2.3.14. Teaching and learning approaches

Teachers of mathematics employ a variety of teaching approaches in which they try to place learners' needs at the core of the learning process. The teacher's method should stress the importance for the learners of making connections between current learning and previous learning experiences in their subject area; as well as in what happens in the classroom and the world beyond (Nelson, 2002). Teaching methods used should provide learners with opportunities to learn in ways that optimize their strengths. The way mathematical ideas were presented in the country of origin may differ from how they were used in the new country, which may cause misunderstanding of mathematics concepts. In some countries, multiplication may start from the left; while in others it may start from the right, as an example of how approaches differ. Secada (1995) as well as Perkins and Flores (2002) pointed out that

immigrant learners face differences in mathematical notation and procedures. In their study, Perkins and Flores (2002) found that Latin American immigrant learners in the USA experienced barriers in understanding their new teachers' teaching methodologies. Those learners had problems in the notational and algorithmic procedural differences between what was used in their countries of origin and the procedures used by their new teachers. In such cases, teachers should take note of such differences in their teaching methodologies; so as to accommodate learners' previous mathematics learning experiences. Teachers need to be aware of new learners' experiences in teaching and learning of mathematics, to make the mathematics, they learn more relevant and beneficial. There is a need for teachers to be encouraged to assess their teaching methods so that learners are more easily motivated positively and use their prior mathematics knowledge and skills. Acknowledging learners' previous knowledge promotes a smooth transition into the new teaching styles used by their current teachers.

Differences in mathematics teaching creates a new layer of confusion amongst many immigrant learners and becomes a challenge for teachers to make mathematics learning less alien to immigrant learners (Jhagroo, 2011). Wilbourne et al. (2011) noted that today's classrooms are constituted of diversified learners from different learning environments and backgrounds. Brown et al. (2006) found that Sudanese learners had difficulties with the language used in the teaching materials and were not able to demonstrate their knowledge of the content. Misunderstanding of mathematics concepts may arise when, for example, textbooks of different countries use different symbols and when mathematical ideas are presented differently from those of the country of origin. Bernardo et al. (2005) echoed these considerations by saying that immigrant learners who had done mathematics in their home countries encountered major challenges when dealing with mathematics word problems in a second language. For example, the multiplication symbols $\times$ and $\cdot$ (dot) means the same in one country but may be used differently in other countries, there is a call for teachers to take note of such differences to avoid confusion among learners.

Wilbourne et al. (2011:461) wrote that "since mathematical problems require learners to understand language, culture, the content of the problems, and the mathematics, the problems can be rather complex and often confusing for culturally and linguistically diverse learners". However, teachers often face difficulties in providing individual attention due to large class sizes, time constraints and amount of content that needs to be covered. Occasionally, teachers teach without emphasis or checking that learners have understood; they rush to complete the syllabus as required by the DBE.

Gorgorio and de Abreu (2009) found that mathematics learners encountered problems in the teaching methods used by teachers in the new country. The new teachers may use unfamiliar teaching methods which sometimes create misunderstanding in the learner, leading to demotivation and possibly failure. Gorgorio, Prat and Santesteban (2007) provided an example from a Spanish school where a learner from Ecuador was marked wrong because the method he had used for long division was different from that of the teacher; although it gave the same answer. Such misunderstanding in teaching methodology may cause confusion amongst immigrant learners; a perception that their previous mathematics was insignificant, undermining their confidence in their previous mathematics knowledge and resulting in poor mathematics performance in the new mathematics classrooms.

Misunderstanding may occur when learners are assisted by their parents and teachers; confusing the methods used even if they are relevant for mathematics manipulation. If mathematics teachers appreciate the methods already familiar to learners from their previous schools, it may improve these learners' understanding of mathematics and grow immigrant learners' sense of belonging. Undermining the other country's ways of doing mathematics or discounting the mathematical knowledge possessed by parents may increase confusion and demotivation among immigrant learners. Some parents, may themselves be knowledgeable about mathematics and may be of assistance to learners and the school system as a whole. Sound rapport between teachers, learners and parents could make for a smooth learner transition in the learning and teaching process.

Sometimes immigrant learners may fall behind through unfamiliarity with the mathematics content and methodology of the new teachers. New teachers may not check for the prior knowledge of immigrant learners or they may repeat content that was already learnt by immigrant learners in their countries of origin. In either case, learners may become disinterested or bored, resulting in them under-achieving. However, Moreira (2009) disagreed with the idea of considering the needs of immigrant learners in the acquisition of LoLT because more time is needed in assisting these learners. Moreira (2009) went on to say that immigrant learners need more time to acquire learning skills as well as to apply these skills in diverse contexts which add to the already heavy burden upon teachers. Brown et al. (2006) found that learners from Sudan had problems in learning to use technology such as watching videos as well as simultaneously writing notes of what they watched. They were not able to watch the videos and write notes about what they watched at the same time. Immigrant learners may be reluctant to

participate in groups because they are unfamiliar with various teaching methodologies involving group work.

Immigrant learners may be reluctant to speak or talk to native English-speakers due to fear of being laughed at or mocked because of limited competence in LoLT. Such learners often lack essential skills to complete assignments or participate in classroom activities such as group or individual presentations. Brown et al. (2006) asserted that immigrant learners with no or low LoLT proficiency levels and no first language literacy present a challenge for governments, education departments, schools and teachers in particular. A quick response through the provision of appropriate and adequate intervention programmes is necessary (APA, 2012).

2.3.15. Teacher-learner rapport

Learners have country specific beliefs about the way they should relate to their teachers. In some countries, such as China, learners are frequently passive and consider that their teachers possess all the knowledge needed. According to Baker (2008), in some cultures, teachers are regarded as superior sources of knowledge whom learners should respect and rely on for learning. These learners are seen as empty vessels to be filled with knowledge; whereas in other countries, learners are encouraged to question the authenticity of what their teachers teach them (Freire, 1996). Freire (1996) suggested that a more world-mediated mutual approach to the learning and teaching process needs to consider learners as incomplete humans who are striving for independence. In China, by contrast, learners are often supposed to be submissive to their teachers (Jhagroo, 2011) and to respond only when asked to do so by their teachers (a teacher-centred approach). This attitude contrasts to that of learner-centred constructivists who believe that learners should co-construct knowledge and teachers should be facilitators (Ernest, 1998). Constructivist theory is based upon the belief that learners construct their own knowledge and conceptual understanding through their own activity; the teacher's role is to establish a mathematical environment where learners can construct mathematical knowledge (Sriraman & English, 2010). Active learners who question their teachers' knowledge and authority are found to perform better and alert teachers to their challenges in the learning process. Based upon this perspective learners are responsible for the construction of their own knowledge through the interaction of new ideas with their previous funds of knowledge and are active participants in the acquisition of mathematics concepts (Haag et al., 2013).

It is essential for teachers to have good relations with immigrant learners; seeing that they are new to the education system and need to adapt smoothly. Suarez-Orozco et al. (2009) concurred

that highly academically engaged learners are actively involved in education and may complete their tasks and perform well academically because of their sense of acceptance and belonging. However, according to the APA (2012) some teachers do not sufficiently take into consideration the needs of immigrant learners. Reacting with anger and shouting at learners are behaviours that are bound to lead to negative teacher-learner relations. Teachers with negative attitudes towards learners may cause learners to become inhibited and withdrawn and may cause mathematics anxiety (Ernest, 1998). For example, *abstraction anxiety* occurs when the teacher introduces new mathematics concepts that demand abstract thinking and learners do not understand, comprehend or do not have the prior knowledge that enables them to understand these concepts (Clements & Sarama, 2009). In a similar manner, the APA (2012) argued that immigrant learners may lose interest in mathematics learning if teachers fail to take their needs into consideration. Teachers need to engage immigrant learners to arouse educational interest that leads to consistent class attendance and sufficient completion of assignments or school-work that would counter failure or school dropout (Rumberger, 2011).

Generally, learners' interests and their attitudes towards mathematics are dependent on their teachers' actions inside mathematics classrooms (Samuelsson & Granstom, 2007).Teachers who are alive and sensitive to their learners' needs usually draw attention to conceptual knowledge and promote a positive learning attitude towards learning mathematics word problems. For instance, some teachers explain concepts until learners understand and they have extra classes to facilitate and guide learners where they encounter problems. A good teacher-learner relation that caters for diversity and promotes learner motivation makes learners feel at home and gain interest in learning, resulting in better academic performance. Antony and Walshaw (2009) found that good interactions between teachers and learners were essential in stimulating mathematical thinking among learners. Brekeimans, Wubbles and Brok (2004) noted that good interpersonal relations between teachers and learners are essential components to a better learning process of learners in every learning and teaching situation.

2.3.16. Sense of caring and belonging

Teachers need to nurture in learners a sense of belonging to the new school environment (Sharma & Lazar, 2019). By building and sustaining positive teacher-learner relations, teachers assist in bridging the gap between school and home cultures while creating essential cultural and linguistic integration with the new school society. Teachers who establish and maintain a supportive learner relation help new learners to fit into the new classroom environment. Teachers who are patient and engage freely with learners allow their learners to understand

better (Samuelsson & Granstom, 2007). In order to promote positive teacher-learner interaction and ensure academic success, teachers should respect immigrant learners' nationality, ethnicity, linguistic abilities and listen to these learners' insights of life and school (Hellison, 2003). When learners interact with their teachers, they acquire appreciation of what they learn, what they are learning and what is happening in their worldview (Samson, 2010). For teachers to construct an effective learning environment, they need to promote an ethos where learners feel secure in their learning by accepting and respecting their classroom contributions. Teachers should do extra planning to cater for immigrant learners' specific learning needs; since these learners differ in their learning experiences of mathematics conveyed through the LoLT (English). Teachers should consider learners as well as providing them with a sense of belonging; they might then learn substantially more and engage in critical and insightful thinking in learning of mathematics. Immigrant learners need to be provided with an adequate and conducive learning environment to develop a positive attitude and mathematical abilities (Orey, 2002).

2.3.17. Learner-learner rapport

The new classroom environment or classroom culture of immigrant learners may influence the way these learners understand and solve MWPs (APA, 2012; Sofo et al., 2013). Immigrant learners should transfer their previous mathematical skills to the new learning environment and form bonds with local learners, co-nationals, teachers, and the entire school community in a positive way. Conversely, if immigrant learners lack peer support, in reading, numeracy, completion of their schoolwork, exchanging learning resources and positive relations, they may lag behind their local counterparts. Positive peer interactions foster fast acquisition of information; resulting in a smooth transition for immigrant learners into the new education system (Suarez-Orozco et al., 2009). Jhagroo (2011) pointed out that lack of patience may sometimes lead to peer-group refusal where immigrant learners may develop feelings of social isolation and loneliness, and believe that they are substandard compared with local learners. Traore (2008) recommended that learners should be cognisant of, and sensitised to, the cultural lives and beliefs of the other learners with whom they interact for them to be able to work together constructively. Teachers are advised to provide learners with opportunities to interact with each other and share mathematics experiences through cooperative learning. Learners should not rely upon their teachers' knowledge only, but should construct and actively contribute to mathematics discussions.

The more closely the cultures of learners are connected, the better their ability to develop proficiency in the medium of instruction (Cummins, 2014). If immigrant learners have close

interactions with local learners, they are better able to communicate in mathematical language; seeing that the local learners are familiar with the LoLT used. The interaction of immigrant learners and local learners has both negative and positive effects on acquisition of LoLT. If learners share similar characteristics, there will be common understanding and better interaction. Immigrant learners may interact with each other, knowing that they are not South African citizens and have a supportive role to play. Co-nationals interact and share information, encourage each other and assist one another in doing mathematics; especially in terms of solving word problems. When immigrant learners are accepted into the culture and enjoy equal status, a sense of belonging to the new society could be promoted. If immigrant learners associate well with the indigenous culture, they could be motivated to learn mathematics together with local learners and find it easier to acquire the LoLT.

2.3.18. Teacher engagement with immigrant learners

Teachers should explicitly structure their mathematics lesson delivery so that all learners and especially English language learners (ELLs) engage in conversations about mathematics in LoLT and promote better understanding of mathematics content taught (Freeman, 2009). Teachers may make use of the language acquired by learners in their countries of origin; using their home languages could make the content taught in LoLT more understandable and comprehensible in learning situations (Freeman, 2009). It could be important for teachers to support and encourage learners with opportunities to read and practice MWPs during mathematics classrooms. Teachers have a major role to play in providing support and encouraging learners to use the core skills of communication which are critical for learner progress. If learners can acquire these skills, they will be better placed to understand MWPs expressed in English, the LoLT in this case (Suarez-Orozco et al., 2009). The challenge for teachers is to focus on mathematics concepts and the use of academic mathematics language to stimulate learner participation. Teachers have to be overtly cognizant of the linguistic demands so that immigrant learners can fully participate in learning MWPs (Freeman, 2009).

2.3.19. Interaction of immigrant learners by teachers

Teachers may teach without being consciously aware of immigrant learners' needs and may use teaching methods or resources that are adapted for local learners only. Awokoya and Clark (2008) stated that the "blanket" grouping of immigrant learners with black local learners can create learning and teaching challenges for teachers; seeing that immigrant learners are placed in the same classes as local learners. Lack of information concerning AILs can have significant influences upon learning and teaching progress, and classroom atmosphere. Immigrant learners

may drop out of school through frustration with the new education system, poor language acquisition and exclusion at school, brought about by poor teacher-learner relations. Devetak, Glazar and Vorgric (2010) echoed this prospect by stating that teachers' classroom cultures influence how learners understand mathematics, conceptualise, interpret, and manipulate mathematics tasks explicitly.

De Jong and Harper (2005) found that teachers lacked knowledge about how to provide for the linguistic needs of students in their learning of mathematics. Teachers were lacking in the preparation of teaching resources, teaching methods, and handling the linguistically diverse classes especially for immigrant learners. To assist learners to learn effectively, teachers need to consider the cultural and linguistic differences and learners' prior learning experiences in mathematics. Teachers need to provide cultural scaffolding by having specific understanding of diverse learners' learning experiences (Gray, 2014). Effective ways need to be found to include learners in the learning and teaching process if they are not to be left behind (Mahofa et al., 2017). Brenner (1998) used Spanish aides to help learners from Spain in the learning of mathematics. Having teacher assistants who share the same home language with immigrant learners could promote effective learning. Fredrickson and Cline (2009) agreed that sometimes English language learners appear lost and disempowered when learning mathematics in languages other than their home languages or their previous LoLT. Brittain (2005) found that the creation of transnational social space in classes promoted better learning. Learners were brought into a special space where the social and cultural capitals from their countries of origins were evaluated. By creating these spaces, immigrant learners could be helped to interact with other learners when learning mathematics.

2.3.20. Teacher training in teaching immigrant learners

There are few or no bilingual teachers for immigrant learners from other countries who could teach diverse learners in both their home languages and in the LoLT of the school (Cummins, 2000). Immigrant learners need to be taught by teachers who share with them the same culture and language; to explain difficult mathematical concepts or vocabulary and simplify mathematical information in their home language. By using code switching, immigrant understand and gradually use the LoLT in their mathematics classrooms. Cummins (2014) found that immigrant learners' literacy and numeracy engagement is promoted when teachers connect with learners considering the LoLT needs of each learner. Teachers should avoid the use of pedagogical space created by 'one-size-fit-all' curriculum mandates; by delivering contents in a way that considers all learners (Cummins, 2014). Teachers need to provide

learners with lessons that make mathematics comprehensible, provide opportunities to talk and express themselves, support mathematical talk and assist learners acquire academic mathematics language (Freeman, 2009).

Due to an increase in the numbers of immigrant learners in mathematics classes, there is a great concern in schools and the nation as a whole regarding provision of resources and in particular, teachers (Abebanji et al., 2014). There is need to develop and prepare teachers to meet the needs of immigrant learners and so achieve quality and excellence in schools. In the USA, Janzen (2008) found that most teachers teaching English language learners were not prepared to work with, or teach, non-native English speakers. This unpreparedness may be a problem in South African schools where teacher training does not have programmes for teaching diverse learners particularly AILs. Candy (2009) asserted that many teachers have misconceptions about immigrant learners; treating them the same as local learners and without considering their home languages and mathematical beliefs. In some cases, teachers use code switching to help learners understand; which may disadvantage those learners with a different home language from that of the teacher; excluding them from the learning process. Wilbourne et al. (2011) noted that teachers may use day-to-day or real-world mathematics that will be appropriate to some learners in the classroom but may exclude others.

2.3.21. Teacher as mathematical facilitator

The teacher is a facilitator between learners and the learning of mathematics in general and MWPs in particular (Adler, 2010). The teacher is responsible for determining the type of communication to be engaged in mathematics classes and acts as a role model of mathematics communication. Setati (2008) asserted that teachers assist or guide learners to use accepted ways of communicating mathematically during teacher-learner interactions. Since teachers interact with learners, learners need to demonstrate persistence and perseverance in doing MWPs; the demand for critical thinking is high (NCTM, 2009). Teachers should provide the enabling environment to help learners develop these kinds of attitudes. Teachers should encourage positive attitudes towards mathematics so that learners expand their mathematical knowledge, gaining confidence by using alternate methods when solving MWPs (NCTM, 2009). When teachers model positive attitudes and promote a culture of solving MWPs, learners see the importance of a positive mathematics attitude. Learners should be able to imitate or model the positive attitude to become adept as mathematics problem solvers. Gyasi (2013:17) emphasised that "teachers are invariably, role models whose behaviours are easily copied by learners, what teachers dislike or like, appreciate and how they feel about their

teaching or studies could have a significant effect on their students, mathematics behaviour, attitude or performance towards mathematics learning".

2.3.22. Understanding immigrant learners' learning needs

Teachers may gather information on immigrant learners' lives and classroom behaviour by interviewing parents, observing learners, or studying learners' records. They may collect academic information from testing new learners; to check for prior learning so that they place them in the appropriate grades. In the case of SA, immigrant learners do not always encounter a smooth transition from their countries of origin because some are refugees from war, suffered economic ills, experienced social problems, or local conflicts. Teachers need to have the required know-how about immigrant learners, so as to have the required strategies to assist such learners in the learning and teaching process in their new countries.

2.3.23. Cultural beliefs in the learning of mathematics

Immigrant learners from different countries may have their own unique ways of manipulating mathematical problems as well as unique educational beliefs and cultural characters. Holmes (2014) pointed out that most teachers and schools portray immigrant families in a negative way without considering the cultural wealth they possess. Doyle (2010) concurred that immigrant learners and their families bring a wealth of knowledge and a culture that may be beneficial to the learning and teaching process. There is need for schools and teachers to reflect on how to involve immigrant learners together with their languages and cultural backgrounds for the benefit of all learners at school. Holmes (2014) found that the involvement of immigrant parents allowed dialogue and bonds to form among teachers, learners and parent, promoting success of the learners. In order to relate to, or understand, unfamiliar cultures, teachers must be familiar with the social and cultural contexts of immigrant learners' lives, and with the values, ideas, attitudes, beliefs and experiences that have shaped immigrant learners (Diego, 2014, Coady, De Jong & Harper, 2013). In agreement, Bicer, Capraro and Capraro (2012:90) considered that "home experiences are vital in shaping children's future mathematical interests, beliefs and motivations since each parent provides different experiences, beliefs about mathematics at home". Brown et al. (2006) found that immigrant learners lacked the cultural knowledge that is linked to some subject content. For instance, in problem-solving, immigrant learners were not familiar with the content or with places in context. As was the case with Sudanese learners noted in section **2.3.14**, even the use of technological devices may create a barrier to learning when learners lack the lived experiences needed to understand the content under discussion. Although immigrant learners may face challenges in learning mathematics, they might

contribute some good attributes such as positive beliefs about mathematics and positive attitudes toward education which can be of good use to the South African education system.

Some learners and teachers accept that mathematics is interrelated with culture (D'Ambrosio, 2001). Mohamed and Waheed (2011) found that immigrant learners' performance was influenced by their attitude towards learning mathematics, including their self-beliefs while doing mathematics and their intrinsic motivation. Steen (1990) found that learners who had a positive attitude towards doing mathematics performed well while those with negative attitudes failed dismally. The importance of mathematics in some cultures can have adverse effects on the way learners learn and value mathematics in their classrooms. According to Waller and Flood (2016), the use of culturally sensitive mathematical activities allows learners to appreciate the importance of mathematics in their classes. Learners' experience with mathematics may stem from their encounters with previous mathematics teachers, from their actual classroom participation, their immediacy with their peers and friends, their study habits, their need to use mathematics in their life world and from their parents' motivation (Samuelsson & Granstom, 2007). For instance, some learners may view mathematics as fun and interesting, while others may view it as an uninteresting subject with a strange collection of skills or techniques. If learners regard mathematics as a cognitive construction, as abstract or as a language, learners could solve MWPs effortlessly (Jhagroo, 2011).

Billings (1997) found that in the USA, African American learners' mathematics knowledge and skills lagged behind because they considered mathematics as a feared and revered subject in their culture. These learners feared and revered mathematics because they believed that it was difficult and signalled advanced thinking reserved only for the intelligentsia (Billings, 1997; D'Ambrosio, 2001). In contrast, immigrant learners took mathematics as a subject that needed to be worked on with perseverance and patience and which was important for their future careers, and so performed better than African Americans. These immigrant learners worked towards achieving good marks even if they encountered problems due to their positive cultural beliefs in the learning of mathematics.

The attitude of learners towards their teachers is said to have a significant influence on their performance. For example, Asian learners' attitudes towards their teachers tended to be influenced by cultural beliefs about the role of the teacher in the teaching and learning process (Jhagroo, 2011; Juggernath & Govender, 2020). In other cases, Chinese learners believed that in order for them to attain good results they should respect their teachers, be obedient and work

harder. In a similar manner, Asian children have been found to perform academically well because of substantial influence and considerate pressure placed on them by their parents (Chow, 2004). These culturally determined learning attitudes may take the form of commitment, love and passion for learning, respect for one's teacher and humility about one's self. In addition, failure was associated with shame and guilt, generally these learners were motivated towards perfection (Samuelsson & Granstom, 2007),

2.3.24. Parent involvement

Involving parents in their children's education may be beneficial to learners since these parents come to understand the expectations of the school. Holmes (2014) found that many immigrant parents were not able to assist their children with their homework because of language barriers. Some parents were not able to speak, read nor write in English the LoLT used for the school Holmes studied, as is common in South African schools. Holmes (2014) added that the language problem creates a barrier between the family and the school. Involving immigrant parents and their families in the education of their children could provide schools and teachers with a productive and holistic teaching and learning environment. Diego (2014) made a similar point involving parents of Slavic immigrant learners in the USA. His study aimed to allow schools and teachers to consider learners' cultural identities. Civil (2008) argued that schools and teachers should acknowledge parents' involvement because they bring different ways of doing mathematics.

Parents may support learners by being assistant teachers as well as by helping the school with learning and teaching mathematics resources, volunteering to assist with their expertise in mathematics, for example some of them are professional teachers or assist in marking learners' work and preparing learners materials. Civil (2008:19) noted that, "through a deeper understanding of their learners' communities and families, teachers may work towards using different forms of doing mathematics as resources for learning instead of viewing diversity as an obstacle to learning". However, Clements and Sarama (2009) argued that some parents are reluctant to check their children's schoolwork; some lack LoLT proficiency. Hemson (2011) found that immigrant learners' parents in SA seldom interacted with the school because they thought that they did not have the right to be involved in their children's education. Similarly, APA (2012) stated that immigrant parents did not know about their expected involvement at school; for example, participating in parent-teacher organisations, volunteering in lesson delivery and becoming motivational speakers at school. In other cases, some parents may assist their children only if there is a particular need. In some instances, parents do not check their

children's work because of their level of education. Lack of awareness by parents of their children's education may lead to learner apathy and reluctance to participate in their own education.

Limited parental or family assistance, in activities such as reading books, writing short stories, doing some simple numeracy, listening to the radio and having excursions, inhibit the performance of learners. Involving parents in activities such as school events, homework activities and mathematics workshops, may encourage parents to be more participative in their children's education (Bicer et al., 2012). Effective parent-teacher communication may be beneficial for learners' mathematics progress. Bicer et al. (2012) argued that, since parents are the original teachers of their children, they could influence learners' mathematics performance.

The inability of immigrant parents to communicate in English as well as having limited levels of education may make them feel inadequate to communicate with children's teachers (APA, 2012). Those immigrant parents who do not have proper documentation (valid work permits) may be afraid of being arrested if they go to their children's school. Work responsibilities may not allow parents to attend meetings; resulting in being left out of important information about their children's' educational needs. For instance, security guards work 12 hours shifts which could be night or day shifts; making it impossible for them to present themselves at their children's schools. The American Psychological Association (2012) pointed out that shift work does not allow enough flexibility for immigrant parents to attend parent-teacher meetings. Parents' failure to be present at parents meetings may be interpreted as negligence by teachers and the school community as a whole.

Low parent proficiency in LoLT may present learners with a challenge of not having educational assistance from their parents. This view is supported by Setati (2008); that English is only heard, read, written, and spoken in the formal school context and not at home. Immigrant parents may not know what the school expects of them in terms of dealing with the learning problems of their children or that they have right to ask and assist in their children's education. Immigrant parents may respect teachers if the norm of their countries of origin is that teachers should not be challenged or approached to discuss their concerns.

To ensure their children's success, immigrant parents should adapt themselves to their new country, new educational system and new LoLT by becoming participants in their children's education. Accordingly, the schools need to keep immigrant parents abreast by sharing

important information about school policies. However, some immigrant parents may have language and communication barriers regarding information about their children's academic progress at school. Some may struggle with reading, speaking, and writing which is a problem; since they may not understand or interpret what their children are learning (Suarez-Orozco et al., 2009; APA, 2012).

Alternatively, immigrant parents who have higher academic levels of education may well assist their children in provision of extra learning resources and opportunities; helping their children to excel or at least succeed academically. According to Suarez-Orozco et al. (2009), parents with advanced educational levels may be able to make available a variety of mathematical materials which could place their children at an advantage relative to children whose parents have lower levels of education. These immigrant parents may provide numeracy, literacy opportunities, hiring tutors to assist their children with schoolwork such as homework, projects, experiments, and assignments. These parents may communicate with their children using a sophisticated English vocabulary, mathematical language and provide technological support such as software that assists learners academically as well as scaffolding their children's schoolwork (Suarez-Orozco et al., 2009).

Immigrant learners of well-resourced parents are more likely to stay in a healthier, safer place that is favourable for learning. In addition, educated parents are better prepared to assist their children with educational needs because they are aware of the importance of education and can see the importance of helping their children cope with school work and adaptation as well as being involved in school activities that support literacy, numeracy and acquisition of the LoLT. Immigrant parents with low English language proficiency may have difficulty in assisting their children's literacy and numeracy development (Cummins, 2001).

2.3.25. Community involvement

Involving members of the community in school activities or projects may help in sharing knowledge between learners and those elders who have already acquired English language proficiency (Cozett, 2015). Cummins et al. (2005) advocated that when none of the teachers or class members speaks the immigrant learners' language, the involvement of school with community members or older learners whose English fluency is better may assist these learners. Encouraging elders to come to school and assist learners, increases the bond between the school and the community; resulting in a free flow of knowledge, ideas and feelings between the community and schools. In Canada, parents and community members were invited to a school

of immigrant children to read in their home language as well as in English. This strategy resulted in learners being able to read dual language story books (Cummins et al., 2005) thus developing their LoLT proficiency, which is needed in solving mathematics tasks.

2.3.26. Use of co-national peers

Allowing learners to sit according to their ethnic groups may promote communication and sharing of knowledge as well as manipulation of mathematics tasks. Cummins et al. (2005) reported that learners from Pakistan were able to assist new arrivals by working together with them, because they were knowledgeable in terms of the English language as medium of instruction. Learners were then able to use both Urdu and English when solving mathematics tasks. Those who were better in English were able to translate English vocabulary into Urdu for those who had a low English proficiency. Moreira (2009) found that immigrant learners who were more knowledgeable in Portuguese were grouped with new arrivals who spoke the same language. Grouping these learners together assisted in the translation of mathematical content in mathematics classes. When learners translated MWPs from English (LoLT) into their home language that helped the new arrivals to understand the learning and teaching material. Ajmal (2010) noted that if learners translated content, it reduced LoLT challenges for learners and simplified new concepts for their better understanding. Orey (2002:45) noted that "Learning is a cultural process by which individuals from the same cultural group can construct their mathematical knowledge in a cooperative way". Teachers could ask for co-national peers or assistants to assist in teaching MWPs. When learners lack communication proficiency in LoLT, teachers encounter problems when they need learners to reason, solve problems, represent, make, and use connections as well as communicate (Suarez-Orozco et al., 2009). Deeper levels of understanding enabled learners to transfer knowledge from one context to another through the use of home language and the LoLT (Cummins, 1986). There is evidently a need for teachers to teach in an approach that nurtures the transfer of concepts from learners' home language to LoLT.

2.3.27. South African language policy

The DoE (2010) states that

- Every child has a right to education.
- Every child should be instructed in the language of his or her choice when reasonably practicable. However, immigrant learners are not given a choice of LoLT.
- Every individual to participate in their cultural life of their choice in an educational institution.

- Attempting to make sure that every person is not deprived the opportunity to get education to the maximum of their ability as a result of physical disability.

The DoE (2010) and DHA (2017) advocate that Language in Education Policy (LiEP) promotes the usage of learners' native languages and LoLT in schools; to ensure that learners communicate in the learning process. This policy is in line with Cummins (1986) but makes it impossible for immigrant learners when their home languages are not one of the South African official languages. Adhering to the LiEP could encourage teachers and local learners to code switch and so disadvantage immigrant learners. The policy shows that the DoE promotes CS or home language to be used in conjunction with the LoLT. Use of learners' home language together with the LoLT would be in line with the education for all learners (DoE, 2010) however it ignores immigrant learners' learning rights. There will be a great challenge for AILs whose home languages are not one of the official languages because these learners could be left out when teachers resort to CS; education for all would not be achieved. Moreover, the policy does not consider the needs of immigrant learners in terms of these learners' proficiency in the LoLT. Myburgh, Poggenpoel and Van Rensburg (2004) argued that if learners are not competent or have low LoLT proficiency, authentic learning and teaching could not take place. It becomes essential to inspire the use of LoLT by all learners. However, using learners' home languages together with LoLT by LiEP brings numerous advantages for the learner, together with increased access and improved learning outcomes while countering drop-out or repetition (World Bank, 2005).

2.3.28. Curriculum of the host country

Unlike in some other countries, the South African curriculum does not make specific provision for the needs of immigrant learners. In the USA and Canada, there are provisions for immigrant learners to have teachers who speak the same language as learners. Learners of one language group could be taught in two languages, English, and their native language, so that they may keep up with academic skills in their home language as they learn English (Thomas & Collier, 2012). Cummins et al. (2012) pointed out that prior knowledge for immigrant learners is encoded in their home languages. The curriculum should permit teachers to teach overtly in a way that fosters transfer of concepts and skills from the immigrant learners' home language to LoLT by explicitly activating or stimulating recall of the prior knowledge of these learners.

2.3.29. Learner assessments

Lack of parental knowledge about the pass requirements of the new education system may cause many AILs to repeat grades upon arrival. The school-based assessments which are offered in SA may not be offered in some of the countries of origin, which could affect their performance and grade progression. Immigrant parents and learners might not know that the school-based assessments count towards their children's end of year results if they were used to final examinations only. Some tasks may need teacher-learner interaction, parent assistance and classroom presentations which might not be used in these learners' countries of origin. Immigrant learners and parents need to be aware and adapt to the new education system for better academic performance. However, South African teachers may carry out assessments in a way that does not consider the nationality of learners in their classes (DoE, 2011). The APA (2012) agreed that in many countries, school assessments have been administered to learners of diverse ethnic groupings without considering cultural or linguistic contexts such as English language proficiency, limited educational opportunities or cultural exposure. Due to the rapidly changing linguistic and ethnicity landscape in SA, there is a need for a considerable shift in the education system policy on school-based assessment and education for immigrant learners (Abebanji et al., 2014).

2.4. Three dimensions framework

Coady, Jo and de Jong (2013) asserted that the way teachers teach is dependent on their decisions, the learning and teaching objectives they follow and the way they approach teaching. To express this, they developed "The 3 dimensions framework" which interrelates teacher knowledge about teaching using a second language, the teacher's background and experiences and the teacher's knowledge of learners in mathematics problem solving (Marais, van der Westhuizen & Tillema, 2013). The interrelation of the three dimensions is useful for effective and efficient teaching and learning process of diverse learners, specifically immigrant learners.

2.4.1. The dimensions of teacher practices with diverse learners

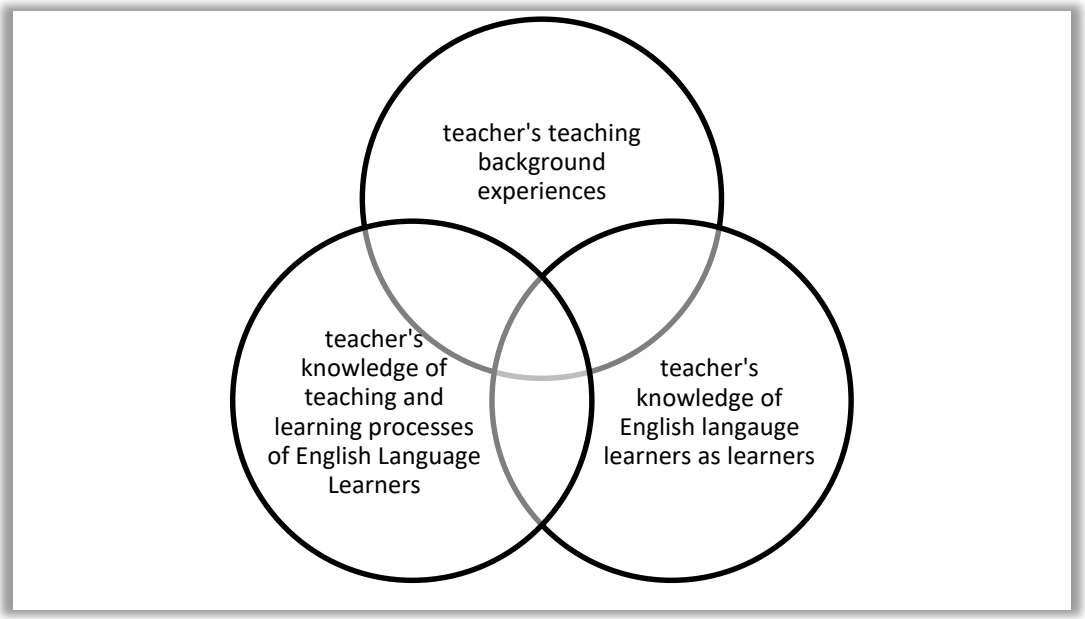

Figure 2.1
Adapted from (Coady *et al*., 2013)

From this model the following deductions can be made:

(a) Teacher knowledge of ELLs

Teachers should be well trained or prepared to meet to teach diverse learners. Being well-trained could help teachers to use the available resources efficiently to teach these learners. Wright (2010:3) noted that "many teachers have not received adequate training in how to effectively address the academic, language, literacy and learning needs of ELLs".

(b) Teacher background experiences

Understanding the needs and challenges of immigrant learners should be a priority for teachers (Wright, 2010). Teachers need to be sufficiently equipped to meet the challenges and should treat immigrant learners in the same way as they would treat other learners (local learners). Teachers of immigrant learners need to work together to make important decisions about programs for these learners. As argued by Wright (2010) "decisions must also be made with an understanding of the historical background or prior learning experiences and socio-cultural contexts in which schools, teachers, learners, and their families are situated".

(c) Teacher knowledge of the teaching process for ELLs

Teachers need to be able to use different learning and teaching approaches such as pair work, group work according to the type of learners they have in their classes (Wilbourne et al., 2011). The manner in which teachers approach and implement their day-to-day lesson delivery should cater for the needs of all learners. Teachers should understand how to use the LoLT for the benefit of immigrant learners and the entire learner population in their classes.

2.5. Conclusion

Chapter two discussed phenomenological philosophy as the underpinning theoretical framework of this study. The literature review highlighted the challenges faced by immigrant learners in the learning of mathematics in their new country was highlighted by relevant literature. Pertinent issues concerning learners' lived experiences, MWPs, LoLT usage in the learning of mathematics, code switching, immigrant learners' mathematics performance, teaching and learning approaches and parental involvement were discussed. The relations and interaction of immigrant learners with teachers, co-national and local learners were discussed. The effects of a range of contributing factors relating to immigrant learners' mathematics knowledge, such as cultural beliefs, parental involvement, teacher preparation, education system, and South African education policy were reviewed in detail.

In the next chapter the interpretive paradigm, phenomenological research methodology, and phenomenological research design and data collection methods applied in the study are discussed. Other facets discussed include purposeful selection as the selection method used, validity and reliability, ethical considerations, and a summary of how the data were analysed.

CHAPTER 3
METHODOLOGY AND RESEARCH DESIGN

3.1. Introduction

In chapter two, aspects of phenomenology that underpinned the study were discussed. The core aim of chapter three is to explain in detail the interpretive paradigm, phenomenological research methodology, research design and data collection methods used in this study. This chapter explains purposeful selection, credibility and dependability of the data collected, ethical considerations and how the data was analysed in the project so as to answer the research questions.

3.2. Research Aim

The aim of this study was to investigate the experiences of African immigrant learners learning mathematics word problems in South African schools in the FET phase. Moreover, the study aimed to develop a conceptual framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving.

3.3. Research question

This study aimed to define, set out and analyse the lived experiences of AILs in the learning of MWPs in the FET phase; by examining this research question: *How do African immigrant learners experience the learning of mathematics word problems in the Further Education and Training phase in the Western Cape Province?*

3.3.1. Sub-questions

The main research question was sub-divided into four sub-questions as stated below:

- How do African immigrant learners experience what they learn in mathematics word problems?
- How do African immigrant learners integrate their past experiences into the learning of mathematics word problems in terms of their relations with teachers and other learners?
- What are teachers' views about African immigrant learners' experiences in the learning of mathematics word problems?
- How can a researcher develop a framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?

3.4. Researcher's role

As a researcher, I was responsible for selecting participants, taking field notes, and interviewing teachers as well as AILs. I was responsible for conducting classroom observations, interpreting, and analysing or explicating the data collected. I audio-recorded and transcribed statements verbatim as soon as possible after the completion of each interview session, as recommended by Wilson (2014). According to Taylor and Usher (2001), the researcher plays a dynamic role in analysis; in identifying and presenting patterns and themes that emerge from the data for interpretation purposes. I recorded data from interviews by making notes and by audio-recording them. I looked for the most appropriate place to interview participants and liaised with responsible authorities on how to gain entry to the research site. The selected venue was a quiet and comfortable place for interviewing participants. I created a relaxing and trusting atmosphere by starting the interview with some social conversations which promoted a free and open atmosphere for participants to share their experiences in the learning of MWPs.

I made participants aware of their roles in the research and the purpose of the research. Participants were allowed to ask their own questions where they needed clarity. I interacted with participants during semi-structured interviews since the study was about defining and recording the realities of participants in the lived world. As a researcher, I endeavoured to keep the focus on learning the meaning of the participants' experiences; by noting participants' behaviours and describing their lived experiences precisely as recorded (Creswell, 2009).

According to Roth and Mehta (2002) the researcher functions as a recorder; to build up a comprehensive and comprehensible account of the sense participants have about the particular issue being examined. Accordingly, the researcher is an instrument serving to analyse and interpret qualitative data and to make sense of the phenomenon under study. My role was to facilitate communication, conducting the study and identifying participants as well as analysing the data; and thanking participants for their precious time spent.

3.5. Phenomenological Research Paradigm

A research paradigm is often interpreted as a set of beliefs or world view and practices that guide the investigation (Morgan, 2007; Neuman, 2011). Gray (2014:57) proposed different versions of paradigms which he described as "shared belief systems that influence the kind of knowledge, researchers seek, and how they interpret the evidence they collect". Various taxonomies that differentiate paradigms share three fundamental elements: the epistemology, ontology, and methodology assumptions. These taxonomies construct a holistic outlook of how

I as researcher view knowledge, how I see myself relative to knowledge and how I go about finding the knowledge. Ontology is a philosophy that concerns the nature of reality, claims about what exists, what elements make it up (what constitutes reality) and how these elements interact with each other (Gray, 2014). Epistemology constitutes a philosophy of knowledge that concerns itself with how one comes to know and what counts as knowledge (Willig, 2008; Gray, 2014). Methodological assumption refers to how the process of investigation takes place and the rationale behind the procedures (Willig, 2008). In every paradigm, certain ontological assumptions inform the epistemological assumptions which in turn inform the methodology; giving rise to methods employed for data collection (Willig, 2008; Gray, 2014).

Of the many diverse paradigms used in research, the three dominant paradigms in the social sciences are: (i) the critical, (ii) the positivist and (iii) the interpretivist paradigms (Myers & Avison, 2002): these are discussed below. The main features of these perspectives are their implied worldview, the nature of knowledge pursued and the different means by which knowledge is produced and assessed within each paradigm (Gray, 2014).

3.5.1. Critical paradigm

In a critical paradigm, knowledge is not considered value free and bias should, as far as possible, be identified and articulated. According to Cohen, Manion and Morrison (2007:26), a critical paradigm "stems from critical theory and the belief that research is conducted for the emancipation of individuals and groups in an egalitarian society". This paradigm emphasizes provision for the growth and advancement of critical knowledge, revealing conditions of constraints and dominance (Gray, 2014). A critical paradigm involves an account of mechanisms placed within the society that aim at changing control and pre-eminence (Lindsay, 2016). Social reality is defined by those in society and is socially constructed through institutions, media, and society. Knowledge is determined by the social and positional power of the advocates of that knowledge (Cohen et al., 2007). Knowledge is produced by power and is frequently as an expression of power more than of truth (Gray, 2014).

3.5.2. Positivist paradigm

Positivism has been a dominant research paradigm for many years; its roots can be traced to the French philosopher Auguste Comte (1798-1857) who viewed human beings in society as a phenomenon to be studied scientifically (Babbie, 2011; De Vos, Strydom, Fouche & Delport, 2011). Positivists believe that an objective reality exists; they consider that all genuine knowledge is value free and objective (Cohen et al., 2007; Descombe, 2010; Babbie, 2011).

According to Auguste Comte, true knowledge is based on human senses and can be determined through experiment. Positivists adopted the scientific method as a means of knowledge generation. Positivism entails a belief that valid knowledge can be produced only on the basis of direct observation by the senses; which includes the ability to measure and record what would be seen as knowledge, resulting in an empirical inquiry (Gray, 2014).

Positivists believe that things that cannot be seen, people's thoughts, experiences, and attitudes, cannot be accepted as valid evidence and knowledge; implications or social aspects are disregarded in a positivism paradigm (Devos et al., 2011). Positivists argue that "reality consists of what is available to the sense for example, what can be seen, smelt, touched" (Gray, 2014). According to Taylor and Medina (2013:3), "Positivists believe that there is a single reality, which can be measured and known, and therefore, mostly involves quantitative methodology, utilizing experimental methods to measure this reality".

Finally, a positivist paradigm is associated with large sample sizes; where validity and reliability are used for quality standards, the data are measured and analysed using statistical methods and generalized laws may be formulated. The social world is believed to exist externally to the researcher; therefore, the researcher and the objects about are separate or independent and generally the focus is on objectivity of the research process (Taylor & Medina, 2013).

Neither critical nor positivism paradigms were deemed to be appropriate for this study since neither were considered to satisfactorily takes into account the lived experiences of participants. A positivism paradigm was not considered apt because it excludes participants' perspectives within the contents of their lives; it rejects participants' lived experiences. Positivism considers reality to be objective rather than being subjective and holds that knowledge is empirically determined rather than constructed by individuals (Lindsay, 2016). Positivism discounts the subjective state of participants; instead regarding human behaviour as passive and measurable through quantitative research. Since this study focused on participants' lived experiences, it could not be aligned entirely with the positivism paradigm but instead followed an interpretive paradigm in discarding the concept that research is value-free.

3.5.3. Interpretive paradigm

According to Lindsay (2016:7) an interpretive paradigm can be termed the "anti-positivism paradigm because it was developed as a reaction to positivism; it emphasizes the ability of individuals to develop meaning". This paradigm is rooted in an understanding of the lived experiences of people (Collins & Hussey, 2009; Rubin & Babbie, 2010; Devos et al., 2011; Neuman, 2011). In an interpretive paradigm, social reality is regarded by numerous people who interpret events differently; leaving various perspectives of a phenomenon (Blumberg, Cooper & Schindler, 2011; Wahyuni, 2012). Intepretivists believe that reality is indirectly developed, based on individual interpretation and is subjective because it is shaped by the perceptions of the respondents and interpreted through the meanings that these participants give to their life world.

In an interpretive paradigm, knowledge is gained through a strategy that respects the differences between human beings and the objects; requiring the researcher to grasp the subjective meaning of the phenomenon (Thanh & Thanh, 2015). Knowledge is gained through personal experience; that is knowledge is constructed by participants' lived experiences. An interpretive paradigm was chosen as the most appropriate paradigm in this study, which advocated the need to consider human beings' subjective interpretations, their perceptions of the world, their-life worlds; as my starting point in understanding the phenomena under discussion (Ernest, 1994; Lindsay, 2016). When applied in this phenomenological study, this paradigm enabled me to build understandings of the life-world experiences of teachers and learners in the learning of MWPs. In phenomenology the world as lived by individuals is emphasized (Vandermause & Fleming, 2011). In this study, an interpretive paradigm generated context-based meaning and was entrenched in a phenomenological view of a life world; as a space for making sense of participants from their peculiar vantage points (Husserl, 1970; Hopp, 2008).

An interpretive paradigm was used to explore the experiences and assisted in gaining deeper insight into the nature of AILs in the learning of MWPs. Diaz Andrade (2009) stated that an interpretive paradigm provides a deep insight into the intricate world of lived experiences from the participants' point of view.

The main reason for using an interpretive paradigm in this study was to make sense of African immigrant learners' experiences through classroom observations and by interviewing participants (Terre Blanche & Durrkein, 2006; Thomas, 2013). An interpretive paradigm was used because it seeks to make sense of, and gain deeper insight into, the nature of participating

learners' lived experiences. This was a phenomenological study which is frequently considered crucial to an interpretive paradigm (Denzin & Lincoln, 1998; Joubish, 2011). An interpretive paradigm guided the way certain acts were undertaken in a natural setting, which allowed me to make sense of the experiences, perceptions and feelings of participants in the real world (Terre Blanche & Durrkein, 2006; Gray, 2009). Neuman (2011:72) agreed that "the interpretive paradigm in qualitative research analyses social actions in their natural setting, through direct and detailed observations in order to understand and interpret how people create meaning in their social world". I focused upon perceptions, feelings, ideas, thoughts, and actions as heard and observed from interviews and observations of participants.

By using an interpretive paradigm, African immigrant learners' portrayal of their experiences was unpacked into rich detail of their learning experiences. I was interested in understanding and interpreting meanings that participants provided about their learning experiences of MWPs. Roth and Mehta (2002) state that an interpretive paradigm assumes that all accounts of reality are moulded by the viewer's unique understanding and perception of his or her surrounding world.

An interpretive paradigm seeks to understand and interpret the lived experiences of participants from their own authentic point of view; providing researchers an opportunity to gain deep insight into the phenomenon under study.

Differences and similarities between the three paradigms in terms of ontology, epistemology and methodology are summarized below:

Table 3.1

Positivism	Interpretivism	Critical	Taxonomies
Reality is real and apprehensive	Multiple local and constructed realities.	Reality is 'real' but only imperfectly apprehensive	Ontology
Objectivist: Findings are true	Subjectivist: Created findings	Modified objectivist: Findings are probably true	Epistemology
Experiments mostly concerned with testing of theory and verification of hypothesis.	Phenomenological The researcher is a passionate participant in the investigated world	Case studies and convergent interviews. Triangulation, interpretation is mainly qualitative but also quantitative methods.	Methodologies.

[Adapted from Lindsay (2016)]

3.6. Research methodology

According to Wahyuni (2012:73), "research methodology and research method are distinctive concepts". Methodology refers to how knowledge is determined in carrying out a research study involving the techniques and data analysis of social science. Research methodology is a way to solve a research problem systematically: it is a "theory of knowledge and imperative framework guiding a particular research study" (Gray, 2014:68). Rajasekar (2006:5) explained that, "essentially, the procedures by which researchers go about their work of describing, explaining and predicting phenomena are called research methodology". Seale, Goba, Gubrium and Silverman (2004) and Schwandt (2007) concurred that research methodology is a procedure or a plan for data collection. Research methodology refers to the research methods, the logic behind the methods used in the context of research and why a certain method or technique is being employed, as opposed to other options; so that research results are capable of being assessed by other researchers or the researcher herself or himself (Kothari, 2004).

3.7. Research method

Research methods or techniques are understood as the methods used by the researcher to conduct a research study. Rajasekar (2006) stated that research methods are the particular procedures used in research which enable the researchers to collect data samples and discover solutions to research questions. I used classroom observations and semi-structured interviews as research methods in this study. Research methods "deal with how the research should be carried out by giving a work plan of a study that consists of a set of specific procedures, tools and techniques to gather and analyse data" (Wahyuni, 2012:73). In this study, I used various techniques and tools such as field notes, interview schedules, observation schedules and checklists for recording data from participants. Consequently, in this study, the research methods were practical ways for collecting data from different participants in a natural mathematics classroom setting.

3.8. Phenomenological Methodology

This study was conducted using phenomenological research methodology embedded in an interpretive paradigm. Phenomenological methodology was applied to explore and to gain deeper understanding of the lived experiences of participating immigrant learners in the learning of MWPs from their own unique perspectives. Phenomenological methodology is concerned with lived experiences and was thus ideal for investigating these experiences of learners as a learning journey (Ajjawi & Higgs, 2007). This view of giving voice to participants was supported by Creswell (2009), who argued that the reality of an object is observed only

within the meaning of the experience of individuals, who were the participants themselves. Phenomenology rejects the concept of absolute facts; considering the world to be socially created; they focus upon the meanings of lived experiences of participants. Pascal, Johnson, Dore and Trainer (2011) explained that the purpose of exploring lived experiences of participants is to comprehend the meaning ascribed to these experiences. By accessing the lived experiences of AILs, I was able to understand the meanings and perceptions of immigrant learners in this study.

The phenomenological methodology was identified as particularly suitable for this study because it allowed for in-depth descriptions of the day-to-day experiences of participants in their natural settings; by using semi-structured interviews and classroom observations to collect rich data in a natural setting. The phenomenological methodology presented participants' lived experiences from their own personal perspectives (Koopman, 2015). Stones and Moss (2013) were of the same view that phenomenological methodology is concerned with studying human experiences as they occurred in everyday life. Patton (2002) asserted that phenomenological methodology explores how people bring their experiences into consciousness. In this study the experiences were those of AILs expressed in their day-to-day situations.

Previous studies such as those conducted by Williams (2007), Marilyn (2011) and Fraenkel (2012) aimed to answer the research questions about participants' experiences using ethnographic case studies. These studies were not able to answer the questions adequately about lived experiences of participants because they did not bracket their preconceptions and they analysed their data rather than explicating them. By contrast, a phenomenological research methodology was used in this research project because it aimed at understanding the individual experiences of participants. A phenomenological research methodology helped me to access the reality about the lived experiences of participants. Phenomenological research provided a rich and detailed description of African immigrants' lived experiences from participants' own authentic point of view (Luitel, 2013).

Phenomenology was used in this study as a theoretical lens as well as a research methodology. In using phenomenological methodology, I aimed to give voice to participants. At its heart, the study was an in-depth questioning of lived experiences; seeking to reveal the voices of participants (Gray, 2014). This qualitative phenomenological methodology examined the lived experiences of AILs in the learning of MWPs by systematically gathering and analysing narrative data in a natural manner. I made a deliberate effort to remain true to phenomenological

theory and research methodology principles by focusing on participants' lived experiences in their natural settings (mathematics classrooms).

This study offered explanations of experienced space, time, body, and human relations as lived by participants themselves (Creswell, 2009). True to the expectations of phenomenological study, I asked participants to describe their concrete lived experiences in the learning of MWPs. The goal of phenomenological methodology is to comprehend participants' human experiences as they are lived in day-to-day life and in a natural environment (De Castro, 2005).

3.9. Bracketing

Wilson (2015) explained that bracketing is a method for pushing aside all pre-existing knowledge and day-to-day suppositions about a specific experience, with the aim of perceiving another individual's lived experiences in an impartial manner. Similarly, Van Manen (1990) referred to bracketing as a way of suspending an individual's numerous views about the reality of the natural world so as to study the significant structures of the world objectively. Bracketing allows a participant's lived experiences to emerge without the intrusion of the researcher's insights about the phenomenon under study (Koopman, 2017). This allowance requires the researcher to set aside assumptions and prior interpretations before immersing her or himself fully in the data. I made a deliberate effort to distance myself from my own experience about teaching mathematics and relied upon statements supplied by participants when analysing the data collected; as recommended by Yuksel and Yildirim (2015).

My beliefs about the experiences of AILs were bracketed in this way so as to focus on the voices of the participants themselves. Although I had experience in the learning and teaching of mathematics, I bracketed my previous experiences in the learning and teaching environment so as not to infuse any biases during the study. Bracketing helped me to be open and see the world from different perspectives and focus on how participants experienced their own unique learning (Finlay, 2009).

Through this method of bracketing, I was immersed in the experiences of participants and was able to view the data in its unique form as if for the first time (Kornhaber et al., 2014). Bracketing enabled me to perceive the participant as a unique individual when conducting phenomenological research (Giorgi, 2005). When bracketing, my obligation was to let the participants' learning experience speak directly.

Bracketing enabled me to describe and interpret participants' narratives without prejudgement about the phenomenon under investigation. Instead I relied upon participants' narratives when explicating data (Landridge, 2007). Bracketing enhanced the trustworthiness, credibility, and dependability of the study. For me to arrive at certainty, I made a deliberate effort to ignore anything outside my immediate experiences; reducing the external world influences so as to arrive at a high degree of certainty (Groenewald, 2004).

Husserl (1962) asserted that researchers in the social sciences are required to set aside or bracket their previous knowledge in order to describe the phenomena under investigation, impartially (Bryne, 2001). According to Husserl, bracketing enables the researcher to detect the essences of learning MWPs free of previous experiences of being a teacher or a learner. Bracketing assumes individuals can isolate their own prior knowledge from their life experiences (Byrne, 2001). Heidegger argued that it is impossible to bracket personal assumptions of the researcher (Byrne, 2001). Heidegger believed that people's previous knowledge and life experiences enable them to share practices and discover shared meanings. In his view, researchers' interpretations cannot actually be separated from their contextual and their previous understanding, so realistically, there can be no complete bracketing of the researcher's preconceptions when interpreting the data (Heidegger, 1962; Giorgi, 1989; Creswell, 2009). In agreement, Van Manen (1990) stressed that phenomenological research is qualitative and interpretive by nature; where the researcher interprets what he or she sees, hears, and understands about the phenomena.

Heidegger (1962) emphasised that personal background or presuppositions may not be made completely explicit because pre-understanding is not something a human being can step outside of, or put separately, since it is understood as already being with us in the world. I agreed with Heidegger's view by accepting that I observed the phenomena through the lens of my personal previous knowledge and life experiences. I was cautious to uphold a conscious awareness of my subjectivity by using personal knowledge and life experiences as a sieve which permitted me to understand the phenomena under investigation better. For this reason, I envisioned my previous knowledge as a strength of my study, rather than a weakness. So far as I was able, I suspended all preconceptions regarding the phenomenon and confronted the subject matter on its own terms while listening to, interacting with, and analysing, the stories of the participants (Giorgi, 2005).

3.10. Selection of participants

The target population of the study was AILs in the FET phase at South African schools. A purposeful selection strategy was used. Patton (2002) defines purposeful selection as a selection method used when information rich and in-depth data are needed from particular participants. Purposeful selection methods allowed me to select information-rich participants (Patton, 2002; Tongco, 2007). Accordingly, 8 South African teachers and 14 AILs were purposefully selected from 2 so-called township schools in the Western Cape Province that had been identified as having high numbers of AILs. The participants were individuals who had in-depth understandings of the experiences of AILs in the learning of MWPs.

Participants were selected for certain characteristics that made possible detailed explanation and understanding of the central themes and puzzles (Ritchie & Lewis, 2003). Selected participants were interested, willing and committed to explore their lived experiences in the learning of MWPs (Wilson, 2015). The carefully chosen participants had experienced the phenomena under study and were able to articulate their lived experiences, so that I was able to find their common experiences, themes and the essence of their experiences (Creswell, 2013). Since purposeful selection seeks to maximize the depth and richness of the data to address the research question within natural time and, I used 2 schools only (Dicicco-Bloom & Gabtree, 2006).

The use of 22 participants only was in line with the requirements of a phenomenological research, which stipulates that the number of participants should be small enough to gain an in-depth understanding of the participants' meaning. Boyd (2001) specified that 2 to 10 participants are sufficient to use in a phenomenological research and Creswell (2009) stated that a phenomenological study uses long interviews with at most 10 participants. According to Moustakas (1994), about 5-25 participants could be selected and be asked broad questions; so that in-depth data could be elicited from them when conducting a phenomenological research. In the same vein, Hycner (1985:295) stated that "phenomenological research requires a limited number of participants since there will be vast data that will emerge from even one participant". Detailed and rich data were collected from this small number of participants for an adequate description of their experiences (Larkin, Eatough & Osborn, 2011). Thus, in accordance with phenomenological research, a small number of participants were purposefully selected since this permitted capturing of rich and in-depth data (Basson & Mawson, 2011).

This study focused on AILs because the majority of immigrant learners in the Western Cape are from African countries. The criteria for selecting participants included that the learners should be AILs who had learnt mathematics in a language which was not English, for their entire school life in their home countries **(Appendix F).** Learners were learning mathematics in English (LoLT) for the first-time at their new schools in the Western Cape Province. The learners were in the FET phase, had stayed in SA for less than 3 months and were taught by a South African teacher. Their ages were between 17 to 22 years **(Appendix F)**. As to the selected teachers, they were South African citizens, full-time teachers at the school, teaching mathematics at FET phase **(Appendix G).** The 8 teachers had been trained at South African universities and colleges to teach in English and their home languages.

The 14 selected AILs were drawn from non-English speaking backgrounds from non-English speaking countries namely Somalia, the DRC, Tanzania, Sudan and Madagascar **(See Appendix F).** The previous languages of instruction at secondary school level of these participants included Somali and Arabic in Somalia, French, Lingala, or Kikongo in the DRC, Kiswahili in Tanzania, Bari, Arabic and Zande in Sudan, Malagasy and French in Madagascar. The language range in the selected participants added richness in the depth of data to be collected, which is the value of adopting a phenomenological study.

The recruitment of mathematics teachers of AILs was justified because these participants were in a situation to provide relevant data about their lived experiences in the learning of MWPs in South African schools. “Teachers participated in this study as data sources because it was believed that teachers’ actions affect learners’ learning experiences; considering that teachers and learners are inseparable in the teaching and learning process” (Mahofa et al., 2017:30). Teachers could have more information about African immigrant learners’ learning experiences. In brief, participants were sharing similar learning experiences, were interested, willing to participate and were available during the duration of the study (Wilson, 2014). Both teachers and learners participated because they were always together and teachers could have supplementary perspectives about what was experienced by AILs (Mahofa et al., 2017).

3.11. Phenomenological research design

A qualitative approach was used in this study with a phenomenological design. Terre Blanche and Durrkein (2006) stated that research design is a strategic framework that bridges the research question and the implementation of the study so as to answer the research questions. The research design deals with the following: what question to study, what data are deemed

significant, what data to collect, how to collect data and how to explicate the results (Yin, 2009). Gray (2009) held that the research design refers to the purpose of the study and the types of questions being addressed, the technique to be used for data collection, samples and how the data are explicated. In this study, the research design was understood as a plan or technique of how the study was to be conducted, so as to provide answers to the research questions about the experiences of participating AILs in the learning of MWPs. The research design was a plan about the procedures undertaken from broad assumptions through detailed data collection methods up to data explication (Bloomberg & Volpe, 2012).

A phenomenological research design was considered well-matched to acquire an in-depth understanding of participants' experiences in the learning process (Merriam, 2015). A phenomenological research design endeavoured to reveal African immigrants' experiences and the meanings they ascribed to those experiences; as well as to discover common or shared learning experiences during the learning of MWPs.

3.11.1. Summary of steps taken in this phenomenological research design

- I identified the research questions, which included questions about the learning experiences of respondents in the learning of MWPs in the FET phase using a phenomenological research design because it was about understanding the lived experiences of participants.
- I bracketed my assumptions about the experiences of learning MWPs so as to describe fully how the AILs viewed the phenomenon from their point of view (Koopman, 2017; Van Manen, 1990).
- I selected participants using a purposeful selection method to make certain that the data collected were provided by those who had lived the experiences of learning MWPs.
- Data were collected by means of classroom observations and semi-structured interviews of the lived experiences of AILs in the learning of MWPs in their natural settings (Starks & Trinidad, 2007). Participants were asked questions about their learning experiences.
- Intervention programme will be conducted as a continuation of data collection.
- Data explication was undertaken in that important statements, narratives, phrases, sentences, or quotations, were used to write descriptions of the participants' experiences (Colaizzi, 1978)

Detailed explanations are provided in the following sections about data collection methods and data explication.

3.11.2. Interview schedules

The interview schedules served as worksheets of topics to be covered during the interviews and were drawn up before the interviews commenced. Thomas (2013) defined an interview schedule as a framework that encourages participants to provide more information through follow-up questions by the interviewer. Interview schedules were prepared for face-to-face interviews with participants in a quiet room. The interview schedules were used to capture data during face-face semi-structured interviews and were kept safely for future data explication purposes. Interview schedules were pre-tested with a group of learners to check the validity of the questions and were rectified before the data collection process commenced. Different interview schedules were prepared for AILs and teachers **(Appendices A and B respectively).** Teachers' interview schedules requested information about experiences of AILs since their time of beginning to teach these learners (i) what problems were encountered and (ii) which strategies were deployed to assist these learners. The interview schedule for AILs was used to gain information about their experiences in the learning and teaching of MWPs as well as the mathematics challenges they faced. The interview schedules included eliciting further discussion and elaboration about participant experiences where the wording and order were substantively modified; based on the flow of the interviews and additional questions were asked as a follow up on what the participants stated (Robson, 2011).

All actions were recorded together with the South African mathematics teachers' and African immigrant learners' views about the participating learners' learning experiences. What AILs stated about their interactions with their teachers and local learners during MWPs classes was recorded. In addition, interview schedules contained specific topics and questions to be covered. I used interview schedules so that I could have some control over the interview. The said schedules allowed for some flexibility in terms of participants' responses. The aim was to explore participants' feelings about the phenomenon under study.

3.11.3. Semi-structured interviews

Semi-structured interviews are the chief data collection method used in phenomenological research, to provide a flexible way of asking participants about their experiences and provided rich data for explication purposes (Thomas, 2013). They are verbal communications where participants articulate their ideas freely to the researcher on a face-to-face basis. Henning van Rensburg and Smit (2006) stated that semi-structured interviews are communicative procedures designed to discover what participants think, know and feel about a certain phenomenon. The

main purpose of the semi-structured interview in this study was to enable AILs to share their perspectives and interpretations of current reality, stories, and experiences regarding the learning of MWPs (Wahyuni, 2012; Merriam, 2015). Semi-structured interviews provided an opportunity to ask open-ended questions and assisted in gaining clarification where possible. Participants were asked to describe their lived experiences in order to comprehend human experiences as actually lived in daily life and not in an artificial environment (De Castro, 2005). The interviews took place in a natural classroom setting and no attempt was made to manipulate participants' behaviour. Audio recordings and field notes were used to record important information of what transpired during interview sessions (**see Appendix C)** for field notes and **(see Appendices A and B)** for interview schedules). There were 8 and 10 interview questions for AILs and teachers respectively. Interviews took on average about 45 minutes per person. Participants were encouraged to narrate freely and relate their lived experiences so that their voices could be heard and to obtain as much detailed data as possible (Lindset & Norberg, 2004). Field notes were taken during the interviews.

Thomas (2013) noted that semi-structured interviews deliver the best of both worlds as far as interviewing is concerned; combining the structure of a list of subjects to be covered together with the independence to follow up on important points. Semi-structured interviews were in an open-ended form and well adapted to serve as a guide for directing the course of the interviews while allowing the use of probing questions (Henning et al., 2006). Similarly, Merriam (2015) stated that semi-structured interviews enable the researcher to ask open-ended questions that elicit narratives and descriptive data from participants. Probing questions encouraged participants to expand on their initial answers, so enriching the data.

The semi-structured face-to-face interview method utilised open-ended questions that allowed greater room for participants to pursue their responses and provide clarification on an issue when required by the researcher (Kornhaber et al., 2014). In the same vein, Penner and McClement (2008) asserted that probes are important; since these encourage participants to clarify the meaning of their responses and enabling in-depth description of essential areas. Semi-structured interviews afforded me the opportunity to probe more information from participants (Smith, Flower & Larkin, 2012).

In-depth, semi-structured interviews captured data in natural spoken form. Semi-structured interviews are important in yielding data of participants' lived experiences and worldviews;

producing rich and in-depth phenomenological data (Henning et al., 2006). Robson (2011) confirmed semi-structured interviews to be a flexible and adaptable way of collecting data.

Semi-structured interviews offer the option of modifying a defined line of investigation; non-verbal cues provide information which aids in understanding the verbal response (Thomas, 2013). Semi-structured interviews allow participating learners to respond to questions, probes and to describe their lived experiences freely about the learning of MWPs. Probes were used as a method for clarifying participants' responses to questions; by asking more detailed follow-up semi-structured questions (Smith, et al., 2012). Semi-structured interviews facilitated rapport between the researcher and participants and assisted in the production of rich data about the lived experiences of AILs in the learning of MWPs. Cohen et al. (2007:349) proposed that "interviews enable participants to discuss their interpretation of the world in which they live and to express how they regard situations from their own point of view".

According to Williams (2007), lengthy interviews are undertaken so as to understand and describe participants' perceptions about the meaning of a certain phenomenon. Semi-structured interviews make allowance for questions to emerge from the dialogue between participant and researcher, which promotes the collection of rich data. Smith, et al. (2012) stated that semi-structured interviews allow the researcher and participants to engage in a dialogue where preliminary questions were modified and probed in line with the participants' response. Semi-structured interviews allowed me to acquire a wider range of responses, enabling me to probe deeply into participants' social and personal matters (Dicicco-Bloom & Grabtree, 2006; Yildiz, Yildirim, Ates & Rasinski, 2012). Semi-structured interviews provided collection of in-depth and rich data and granted participants the freedom to respond to questions, while probing and relating their experiences in a narrative manner. Open-ended questions assist the researcher to obtain immense quantities of data from participants (Basson & Mawson, 2011; Anderson, Cosson & Mclntosh, 2015).

Semi-structured interviews were useful for gleaning more in-depth information about participants' experiences and insights in relation to the learning of MWPs. Shrestha (2011) claimed that semi-structured interviews provide opportunities to read participants' facial expressions and body languages. Semi-structured interviews were useful for collecting subjective viewpoints from participants themselves as well as being useful as a follow-up to classroom observations.

As stipulated by Brayda and Boyce (2014), I was cognizant of ethical challenges associated with qualitative interviews. I made sure that no personal rights were violated before, during or after interview sessions. Because semi-structured interviews are time-consuming, I conducted interviews when participants were free; discussions were confined to relevant questions. The semi-structured interviews were scheduled in a suitably private quiet venue with comfortable chairs and took place after school hours so as not to disturb the day-to-day running of the school programmes. Caution was taken to make the interview setting free of noise and interruptions by putting a "do not disturb" note on the door. By these means data in the form of interview schedules, field notes and audio recordings were gathered for future data explication.

As a researcher, I worked closely with participants in order to collect rich data about their experiences. In cases where data collected were not clear, a second interview was conducted to discern deeper understanding and clarify certain aspects. Data were collected for a period of 15 months. Finally, the interview output was a narrative account of participants' knowledge and experiences (Lopez & Willis, 2004).

3.11.4. Guidelines for conducting semi-structured interviews

A guideline was followed on how to conduct interviews. During the interviews I listened more and spoke less. Questions were made clear and straight forward. A free and conducive environment for conducting interviews was provided so that participants could not feel uncomfortable.

I built trust and established rapport with participants by providing them with appropriate assurances of confidentiality and anonymity. These steps made participants feel comfortable and able to respond to questions honestly and freely. I showed empathy, listened actively, and maintained eye contact when conducting interviews by starting with social questions. I did not show any strong reactions or emotions but maintained a neutral conduct and stayed in control of the interview. Although, it was essential to tolerate flexibility during the interview, I set the direction for the interview and kept participants from wandering away from the topics under discussion.

Participants were taken to a quiet room which provided privacy. Having a quiet venue allowed participants to articulate their ideas without disturbance from outsiders. I obtained consent from participants before conducting the research. I introduced myself to participants and explained to them the purpose of the study, the time for each session and the use of data collected. The process for data collection through semi-structured interviews was clearly explained to all

participants, as to what the data were to be used for as well as the ground rules. I was given permission by participants to proceed with conducting semi-structured interviews. Ethical issues were discussed and explained to participants before commencing one-on-one interviews.

Participants were given the opportunity to ask questions and were promised confidentiality and anonymity. I listened to audio-recoded interviews and wrote field notes during the interviews. Individual semi-structured interviews were conducted for a period of 45 minutes or more per participant; depending on the information provided. I scheduled the interview time that was most convenient to participants well in advance as well as making eye contact with the interviewee throughout the interview session. I encouraged participants to narrate as freely as possible their lived experiences. The participants were free to relate their lived experiences in order for their voices to be heard (Lindset & Norberg, 2004). Finally, I thanked participants for their time and contribution to the study.

3.12. Classroom observations

Classroom observations were undertaken after having conducted the semi-structured interviews. Observation is a data collection method by which the researcher is present in the field and is active to learn about the activities of the participants under study in their natural setting (Merriam, 2015). There are two main kinds of observations: non-participant and participant observations. A non-participant observer plays only an onlooker role, where there is little intrusion into the phenomenon under observation. On the other hand, a participant observer is an active member of the group under study; taking on their skills and customs, which facilitates the researcher to acquire a comprehensive understanding of the phenomenon under study. In this study, non-participatory classroom observations were used to increase rigour, trustworthiness, credibility, and dependability of the observation data. This data collection method assisted me to obtain rich and in-depth information about the lived experiences. Classroom observations permitted me to record thoroughly participant behaviour in the classroom setting so as to obtain an in-depth insight into the participants' lived experiences in the learning of MWPs. Classroom observations allowed me the opportunity to document participants' behaviours reasonably accurately, rendering them a good primary source of data (Merriam, 2015).

Gray (2014) argued that classroom observations provide a systematic method of determining the behaviour and interactions of participants in a real-world setting. I observed AILs over a period of about 15 months at their schools; focusing on their mathematical learning experiences.

Their lived experiences in mathematics classrooms were captured to collect more information about the experiences of these AILs. Classroom observations served to determine whether the learning and teaching methods used were flexible, sufficient to accommodate the needs and learning styles of AILs.

Classroom observations allowed me witness what really happened in the mathematics classes between the teachers, local learners and AILs. As a researcher, I liaised with participating mathematics teachers to arrange convenient times to be observed. I informed participants about the times for conducting classroom observations so as to avoid the dangers of the Hawthorne effect (the change of behaviour by the subjects of a study due to their awareness of being observed). To minimise this interference, sufficient time was set aside to let participants grow accustomed to the idea of being observed, increasing the reliability of the study. Participating teachers were asked to choose days where they could be observed teaching learners MWPs. Classroom observations took place in the participating teachers' classrooms and each session lasted for 45 minutes (duration of a lesson) resulting in 90 minutes per teacher or more if required. Classroom observations were conducted both during and after school hours from 8 am to 4 pm for about 45 minutes per participating teacher. In these sessions I observed carefully what was happening using the observation schedule **(see Appendix D),** for example, the steps of problem-solving followed by learners as well as the process of mathematization as an important component of problem solving involving the interaction of participants in the learning of MWPs. I did not participate in any activities undertaken by participants (as a non-participant observer) and did not disturb participants in their activities. I was unobtrusive and watched participants completing their activities allowing compilation of detailed field notes **(see Appendix C)** for future purposes. I merely recorded what took place during the teaching and learning of MWPs. I observed participants' behaviours as they took place in the classroom environment without intervening in any way. Through personal observations, I observed the actual behaviour as it occurred in the natural setting of the mathematics classroom.

As a non-participant observer, I watched, audio-recorded the language used and noted any other aspects of what took place in the classroom. By carefully and purposefully watching and listening, I was in a position to discover the truth, in a phenomenological sense, about the experiences of African immigrant learners' day-to-day lives in their mathematics classrooms. Observation schedules **(Appendix D)**, observation checklists **(Appendix E)** and field notes **(Appendix C)** were used to capture what happened during teaching and learning process (Creswell, 2013). Classroom observations were conducted, and field notes were recorded,

comprising essential participants' descriptions. For example, participants' nonverbal communication such as "eye contact, posture, tone of voice, speech patterns and emotional responses were recorded" (Arbour & Wiegand, 2014:5).

During classroom observations, I took field notes of the following:

- The physical setting of the classroom such as space utilisation, seating arrangement of learners and the teacher. In addition, the teaching and learning resources such as technology and textbooks, used were observed and recorded. The programme setting of resources and their organization, and pedagogic styles were described.
- The number of learners in the classroom, what these learners were doing and their characteristics as well as the delivery of the curriculum by the teacher.
- The activities and interactions of participants were observed and how they interacted with each other. I observed whether AILs sat together, interacted with others, and were incorporated into local learners' groups. Did the teacher interact with all learners, especially the immigrants? Notes describing the interactions were taken. I noted participants' conversations, their non-verbal behaviours while verbatim quotations were recorded. The language used during classroom activities (interactions) by the teachers and learners was noted and recorded during classroom observations for future interpretation and data explication (Merriam, 2015).
- The problem-solving steps followed by teachers and learners as well as the process of mathematization executed by teachers and AILs.

After having conducted classroom observations, I informed participants about the use of the data and its accessibility after completion of the study. Participants were reassured about confidentiality and anonymity.

3.12.1. Reasons for using classroom observations

Classroom observations were used because they were essential for me to observe the social behaviours of local learners, teachers and AILs when engaging during the learning and teaching of MWPs. Classroom observations were essential in that they collaborated with interviews as I asked participants about their views, feelings or attitudes which were vital issues to get a holistic sense of what happens during the learning of MWPs. In the classroom, I was able to watch what participants did and listened to what they said (Robson, 2011; Putter-Smith, Taconis & Jochems, 2013). Classroom observations were considered vital because they gave greater

insight into participants' lived experiences through seeing and hearing what the participants were doing in the classroom.

Classroom observations complemented data collected through semi-structured interviews and were used to assist in building an in-depth understanding of how AILs interacted among themselves, with their mathematics teachers, and with local learners. These observations enabled me (i) to hear the language used by participants, and (ii) to observe the interactions such as working in group, teaching methodologies used and teacher-AILs interactions. In this study observing was considered a powerful method for gaining insight into the set phenomenon. Nevertheless, classroom observations can affect the way participants behave. For instance, participants may not feel comfortable being observed or may not show their real characteristics when the observer is around.

3.12.2. Classroom observation schedule and checklist

An observation schedule and checklist were used during classroom observations for recording actions quickly and accurately (Creswell, 2013). The observation schedules and checklists provided a guide for collecting and recording data accurately as well as for simplifying the coding and explication of data. The use of observation schedules and checklists promoted reliability in collecting data (Creswell, 2009). Observation schedules and checklists assisted me to observe, watch directly how participants behaved and acted when doing MWPs in their classrooms. They were prepared well in advance and contained details of what exactly I had to look for and how those observations should be recorded **(Appendix D and E).** Phenomena such as the classroom atmosphere, interaction between learners and teachers, between AILs and local learners, and language used were noted. The observation schedule focused on interactions of teacher-AILs, teacher-local learners, and AILs and co-nationals. The observation checklist focused on components such as linkage of learner prior and present knowledge, LoLT use, interactions, mathematics academic language, mathematization processes and problem-solving steps followed by participants. The same observation schedule and checklist were used for each teacher. In order to collect sufficient data for future data explication purposes, each teacher was observed at least twice to give a at least a total of two observations and two audio recordings per teacher.

3.13. Field notes

Field notes are the written explanations of what the researcher hears, sees, experiences, and thinks when gathering and reflecting on the data in a qualitative study (Bogdan & Bilken, 2003).

I kept field notes on the behaviour and activities of participants in their classrooms when learning MWPs and during semi-structured interviews. Creswell (2013) asserted that observations are successful when incorporated with field notes. Field notes were important for recording what I saw and heard, and helped in obtaining a comprehensive account of participants, events that took place, actual discussions, and communications (Silverman, 2011). Gray (2014) agreed that field notes are important instruments in a phenomenological research for collecting data during observations and interviews.

Field notes **(Appendix C)** were useful as an additional opportunity for data collection. More attention was paid to language usage during semi-structured and classroom observations. Field notes were later expanded to constitute extensive records which provided an opportunity to record and comment on the actions or activities that took place between AILs, teachers and local learners learning of MWPs.

In an effort to avoid any loss of data, field notes were compiled and transcribed as soon as possible after the classroom observations and semi-structured interviews and if possible, on the same day, when information was still fresh. Field notes from classroom observations gained data from participants who did not want to express themselves during semi-structured interviews.

Field notes were used as a data storage technique in this phenomenological research.
Field notes recorded:

- What happened and what was involved?
- Who was involved? (For example, how AILs interacted with both the teachers and local learners).
- Where did AILs sit in the classroom?
- Where did the activities occur?
- How did the teaching and learning process take place?
- Why a notable incident took place and how did it develop?
- What body language, facial expressions, tone of voice were displayed?

Field notes were used to record as soon as possible, what I heard, saw, experienced, thought and reflected on in the course of collecting data.

3.14. Ethical considerations

I adhered to the requirements of the Ethics Research Committee of the Cape Peninsula University of Technology (CPUT) in terms of respecting the rights and ensuring the privacy, confidentiality, and anonymity of participants. It was my responsibility to ensure that ethical standards were adhered to. Measures such as anonymity and confidentiality were taken to ensure that the rights and welfare of participants were protected and that no harm to anyone occurred during the time the study was conducted.

3.14.1. Informed consent

Consent forms are measures that accord participants the opportunity to decide whether they want to participate in a study or not. Consent forms were issued to all participants requesting their participation **(Appendices J and K).** Letters were sent to the Western Cape Education Department, school principals, AILs, parents of AILs and teachers, asking for permission to carry out the research and to involve them in it **(Appendices H, I, J and K).**

Participants were asked to sign consent forms **(Appendices J and K)** which acknowledge their right to withdraw at any point during the course of the study if they so wished as recommended by Basit (2010). Williams (2007:72) noted that "research participants have full autonomy and confidentiality; they have the right to understand the researcher so that they can decide to participate in the research or not". All learners under eighteen years old were given consent forms for their parents or guardian to sign. Participants were notified about the purpose and procedure of the study as well as how their contributions would be utilised after completion of the study.

The informed consent form was used as a contract binding the researcher and the participants in terms of the value, purpose of the study and use of data as well as protecting the interests of both the researcher and participants (Derry, 2007). Participants were given clear and detailed information about the research aims, purpose; and importance of the study and the use of the results before the study commenced. Informed consent was explained to participants for them to understand what was needed for them to participate. I wrote letters to teachers, parents, and guardians of AILs, explaining the purpose, significance of the research, benefits and risks of participating in the study. Consent forms were signed soon, once the purpose, aims and significance of the study and the process were clarified to all participants (Lee, Landy, Wahoush, Khanlou, Liu & Li, 2014).

The APA (2012) stated that researchers must articulate how the study could contribute towards improving the lives of participants and delimit any potential risks. I ensured that all relevant information was provided to participants about the research before the commencement of the study. I provided the envisioned participants with a complete explanation of:

- The right for participants to withdraw participation of the activities at any time.
- The right to have privacy and confidentiality.
- The right to turn off a recording device at any time of the interview or observation if need be.
- The right to a clear explanation about the purpose and the procedure for undertaking the research.
- The right to ask questions at any time for clarity.
- The right to obtain the results of the study upon completion.

3.14.2. Confidentiality

Participants' identities were protected through the use of pseudonyms such as **Rana, Simbe**, for learners: while participating teachers were referred to as **Mr Erdan, Ms Mdamanest and Mr Roca (see Appendices F and G)**. Participants were informed that all information collected in the study would be kept confidential **(see Appendices J and K)**. Participants were informed that all research findings would be made available to them after completion of the study. African immigrant learners without proper documentation were promised that their identification would not be disclosed to any one because these learners were afraid of the law enforcement personnel. In the same vein, Moustakas (1994) stressed that participants have to be totally informed and respected in their privacy; so that all data collected are confidential and protected from outsiders. The APA (2012) supported the idea of protecting participant identities by stating that the present climate of deportation for undocumented immigrants needed additional precautions to protect the identities of participants. Therefore, I protected participants from being identified by assigning pseudonyms. I placed transcribed interviews, field notes, observation schedules, as well as signed consent forms and other digital records under lock and key.

The APA (2012) pointed out that the strictest ethical standards must be supported to maintain the trust of participants; not placing them in danger. Blom and Gabtree (2006) concurred with this view by asserting that collected data need to be cautiously secured and routinely destroyed after transcriptions are made or once explication is completed to protect participants' identity. I adhered to the relevant policies and codes of good practices according to the CPUT research guidelines for researchers for adhering to ethics considerations. To sum up, confidentiality,

anonymity and non-traceability were guaranteed to all participants before undertaking the research (Seale et al., 2004).

3.15. Sites

The study took place at two township secondary schools in the Metropole of the Western Cape Province in South Africa. The classroom observations were conducted in the participating teachers' classrooms while the semi-structured interviews took place in a separate venue with a favourable environment which was provided by the school as discussed under heading **3.11.3.**

3.16. Credibility and trustworthiness

According to Creswell (2013), credibility and trustworthiness are terms used in qualitative research to replace the concepts of validity and reliability. Guba (1981) and Bitsch (2005) hold that validity and reliability are parallel to credibility and dependability respectively, in qualitative research. In this study validity was ensured through various methods used in qualitative research. Much attention was paid during data collection and analysis of data to ensure credibility and trustworthiness of the research process (Ritchie & Lewis, 2003; Cohen et al., 2007). Data collection and analysis were undertaken in a rigorous and repetitive manner to ensure validity: by using recordings of participants' verbal responses to capture data in its raw state (Cohen et al., 2007; Creswell, 2014).

Credibility was supported by member checking, peer review, external audit, and prolonged involvement in the study. Member checking involved asking participants to review their transcribed semi-structured interviews. Member checking was considered a valuable method of guarding against research bias (Robson, 2011). Member checking showed respect and value for the responses of participants. However, member checking may cause problems with participants when some of them want to remove some of the information. I mitigated this problem by sharing the guidelines with the reader and came to some agreement as well as having a third person to assist in member checking process. Member checking was used as the most important element in promoting credibility (Guba, 1981).

To reduce bias by introducing a third party, I requested a colleague to approach participants to verify the transcribed narrations. Using member checking in this way as a method for ensuring credibility and trustworthiness in the perception of participants allowed for the accurate capture of participants' thoughts and beliefs.

I requested my supervisors and other researchers familiar with this field to discuss the findings and interpretation so that they could provide useful insights. According to Rolfe (2006), peer checking can be used to increase credibility of data collection and analysis. I debriefed my supervisors and colleagues at each stage of data collection and explication for them to critique and provide valuable suggestions. Raising continuous questions about data collection, findings, and analysis, provided a greater insight into how I conducted my research process. Knowledgeable collaborators were used as critical friends to provide suggestions and recommendations on the collection and explication of data.

External auditors or outside experts were used to assess the quality of the study by referring it to blind reviewers before it was submitted to examiners; to gain deeper insight into the interpretations and conclusions. The use of external auditors who were unknown to me provided a critical review of the study, enhancing its credibility and trustworthiness (Guba & Lincoln, 1985). I presented at research conferences so as to allow critical comments about the methods and findings which enhanced the credibility and trustworthiness of the study.

Credibility and trustworthy data were enhanced by prolonged involvement through classroom observations and semi-structured interviews involving data collection over a period of 15 months as well as follow ups. Long-term involvement in data collection enabled me to develop in-depth understanding of participants' learning experiences in MWPs. I presented the research during its developmental stages, work in progress, at several conferences as a way of obtaining critique from academicians. This method validated the study. Emails were sent to selected participants to do follow up interviews where there was need for more clarity from participants. Participants who were approached were willing to be interviewed and responded accordingly. This iterative process helped to validate data and ensured that the results were dependable and trustworthy. Credibility, rigour, and trustworthiness of the study were supported through member checking, peer review, external audit, and prolonged involvement in the study.

3.17. Dependability

In qualitative research dependability parallels the concept of reliability and refers to the stability of findings over time (Bitsch, 2005). In this study dependability was ensured through the use of appropriate data collection instruments, triangulation, audio recordings and prolonged involvement in the study. I carefully developed and used appropriate data collection instruments such as interview schedules, field notes and observation schedules that provided rich data about the lived experiences of AILs in the learning of MWPs.

Bitsch (2005) propounded that dependability of research discoveries was ensured by an in-depth research process and procedural judgments. Accordingly, explanations were provided of how data were collected, which instruments were used as well as the rationale for using classroom observations and semi-structured interviews. These steps provided dependability. Dependability in semi-structured interviews was ensured through the use of standardized interview schedules and field notes while in classroom observations it was supported by using pre-designed observation schedules and field notes (Gray, 2014). In addition, dependability was ensured through clear explanation of the researcher's position in relation to the process of data collection and data explication. The extended data collection period of 15 months helped ensure its dependability by verifying consistency over a long time.

3.18. Triangulation

Dependability was enhanced by using triangulation. Guba (1981) stated that this use of many methods compensates for the weaknesses of one method by the strengths of the other. The variety of data collection methods also strengthened the stability of the study. De Vos et al. (2011) contended that triangulation helps to ensure that the study is rigorous, credible and justifiable. In this study, the variety of data collection included classroom observations and semi-structured interviews as well as a wide range of participants; teachers, AILs from different African countries. In addition, the researcher used multiple literature sources such as field notes, audio records, interview schedules and observation schedules. These data sources for triangulation confirmed the themes and patterns emerging from data analysis (Dantas, 2007). Cohen et al. (2007) claimed that classroom observations and semi-structured interviews form a triangulated study of patterns of conduct. The interviews enriched the observed data through triangulation, which helped me to interpret data in a more insightful manner. Gray (2014:177) added an angle that "collection of data with a variety of data collection methods promotes the gathering of thick descriptions by triangulation". The varieties of data collection methods I used fortified the stability of the study.

In summary, triangulation reduced biases and possible distortion of findings and promoted credibility, trustworthiness, and dependability of the study. The use of multiple data collection methods and data sources to achieve triangulation assisted in balancing out the weaknesses of the individual data collection methods and data sources (Gray, 2014).

3.19. How data were explicated

After having completed data collection from participants, I developed a comprehensive method for interpreting and explicating the essence of the lived experiences of participants. Participants' descriptions of their experiences of this subject were systematically explicated by following Colaizzi's (1978) phenomenological data analysis strategy (Sanders, 2003; Shosha, 2012). Colaizzi's method allows in-depth data analysis; with opportunities for critical consideration, while keeping the procedure manageable. In this way the meanings of African immigrant learners' lived experiences in the learning of MWPs were unravelled using my face-to-face interactions with participants to construct a more sophisticated representation of reality than prior understandings (Husserl, 1970).

In this phenomenological study, both descriptive and interpretive situations were legitimate and overlapped (Wilson, 2015). Although, Colaizzi's (1978) descriptive data analysis was used the influence of the researcher could not be completely bracketed during data explication because the researcher was necessarily a vehicle by which reality was revealed. The researcher's interpretations played a crucial role in the study in terms of the interpretive approach towards lived experiences which assert that the researcher and the researcher's "world" are inseparable (Garcia-Coll, Akiba, Palacios, Silver, DiMartino & Chin, 2002; Wilson, 2014). Thus, both descriptive and interpretative analysis of participants' experiences were conducted. The data analysed was used to design a conceptual framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving.

3.20. Conclusion

In this chapter, I discussed and described the interpretive paradigm, bracketing, phenomenological research methodology and design of the investigation. Purposive selection, data collection methods, ethical considerations, validity, and reliability were then discussed in detail. Classroom observations and semi-structured interviews were used as data collection methods that allowed for the explication of data. In summary, this chapter justified that the methodology espoused would yield the most credible and dependable data to apprehend and present the personal lived experiences of AILs in the learning of MWPs. To obtain thick descriptions, the researcher triangulated multiple data collection methods, data sources and participants' perspectives. The following chapter, chapter four, presents the data, its analysis and discussion of the research findings arising from the interviews and classroom observations.

CHAPTER 4
PRESENTATION OF DATA, ANALYSIS AND DISCUSSION OF RESEARCH FINDINGS FROM AILS

4.1. Introduction

In chapter three, the research paradigm, research design and methods of collecting data were set out, followed by ethical considerations, credibility and dependability issues related to the collection of data and procedures for analysis. These issues all concern the main research question: *How do African immigrant learners experience the learning of mathematics word problems in the Further Education and Training phase in the Western Cape Province?* The sub-questions were phrased as follows:

- How do African immigrant learners experience what they learn in mathematics word problems?
- How do African immigrant learners integrate their past experiences into the learning of mathematics word problems in terms of their relations with teachers and other learners?
- What are teachers' views about African immigrant learners' experiences in the learning of mathematics word problems?
- How can a researcher develop a framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?

Data collected from semi-structured interviews and classroom observations are presented, and discussed in detail in this chapter. The study used narratives presented by AILs and teachers as raw data for reconstructing the lived experiences of these learners learning MWPs. Data were collected through semi-structured interviews, classroom observations and field notes. Detailed procedures for data collection were presented in chapter three. Pseudonyms were adopted for participating teachers and AILs; to protect their identity and to be in line with the CPUT Research Ethics Committee's confidentiality requirements. African immigrant learners were assigned pseudonyms such as **Rana** and **Simbe,** while participating teachers were identified as **Mr Erdan**, **Ms Mdamanest**, and **Mr Roca**. Participants' voices were used because they provided thick, in-depth and descriptive quality data, which is the major aim of a phenomenological study (Edward & Welch, 2011). Participants' views are emphasised in this chapter by using extracts from face-to-face, semi-structured interviews. The four life-world existential aspects of lived time, body, others, and space which transcends all human beings, provided the fundamental existential structure within which these experiences were explored (Merleau-Ponty, 1962; Van Manen, 1997).

4.2. Analysis of Data

The process of analysing data comprises the main phase in any phenomenological study since it includes the task of weaving back and forth between the whole and the parts in order to identify the essence of the experiences recounted by respondents (Van Manen, 1990). According to Van Manen (1997:19), data are analysed in order to "construct an animating, evocative descriptions of human actions, behaviours, intentions and experiences as we meet them in the life world". African immigrant learners described their learning experiences in distinct, discrete lived worlds which included the world (i) in relation to the self, (ii) to the world in relation to significant others, (iii) to the environment, and (iv) their world in relation to time. A phenomenological approach provided a vital perspective that helped illuminate some of the critical issues affecting the learning experiences of AILs (Van Manen, 1997; Makoe, 2008; Shosha, 2012), with the aim of exploring these learners' everyday lived experiences.

In this phenomenological study, both descriptive and interpretive situations were legitimate and overlapping (Wilson, 2015). Although Colaizzi's (1978) descriptive data analysis was used the influence of the researcher was not completely bracketed during data explication in the sense that the researcher was a vehicle to whom aspects of reality were revealed. Van Manen (1997) posited that "the idea of being-in-the-world is used to present an inseparable relation between the "experiencing person" and "object of experience". The researcher's interpretations played a key role in this study because an interpretive approach towards lived experiences asserts that the researcher and his or her unique "world" are inseparable entities (Garcia-Coll et al., 2002; Wilson, 2014). Both descriptive and interpretative analyses of African immigrant learners' experiences in the learning of MWPs were conducted. Data collection and analysis were undertaken simultaneously, since analysis was a continuous process; every data set collected was simultaneously analysed. I carried on with data analysis in the knowledge that raw data had no meaning unless adequately analysed. This analysis procedure required that transcripts be read several times before interpretation; to make sense of them (Creswell, 2013).

Data were separated into different categories as explained in chapter three. Categories were determined and merged into themes. Major themes emerged from the analysis about the experiences of AILs in the learning of MWPs; as illustrated in the model diagram below:

Major themes

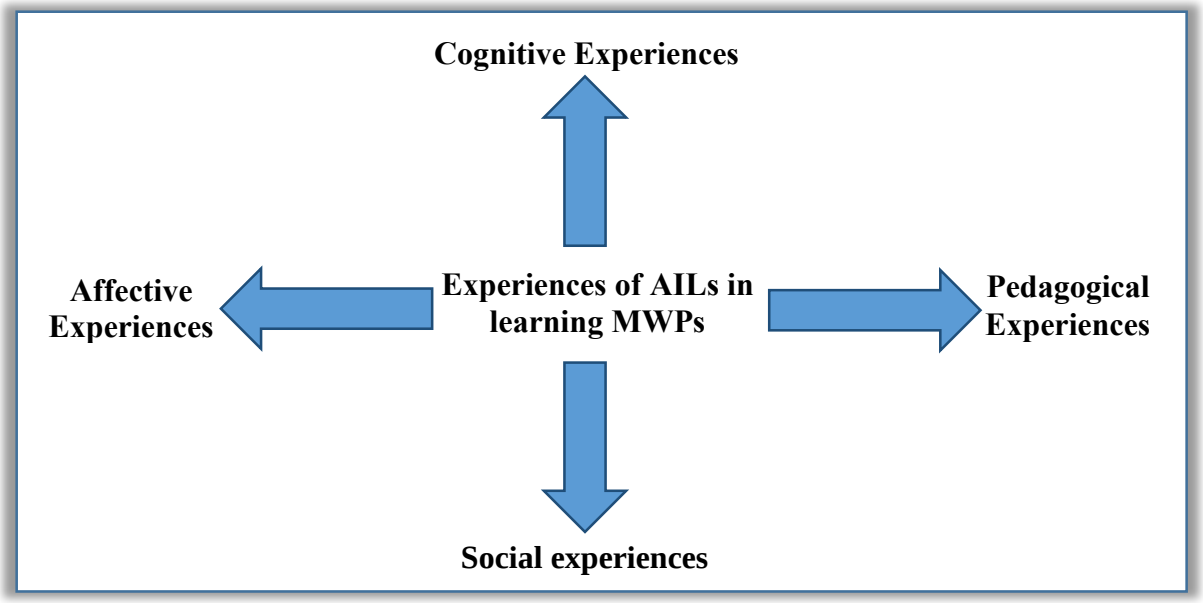

Figure 4.1

These lived experiences of real learners provided meaning and understanding of what being a new learner in a mathematics classroom was like for an AILs in a South African mathematics classroom (Van Manen, 1990; Sanchez, 2007), which brought together the past and present learning experiences in a South African context.

4.3. The impact of the LoLT upon participants

Study participants expressed and explained their everyday lived experiences as a sense of exclusion, of being left out during the learning and teaching of MWPs due to their limited language proficiency. The reason for this omission or sense of neglect was chiefly that LoLT was considered to be the tool that allowed learners to conceptualise content and knowledge of any learning area. The DoE (2014:8) stated that:

> *Language is a tool for conceptualising content and knowledge, and expressing oneself accordingly in a rational, 'academic' style, based on subject-specific conventions and registers so that in every institution of learning, the language of learning and teaching (LoLT) should be developed by all teachers, while disseminating knowledge to help learners in their day-to-day learning.*

Angateeah, Hurchand, Sukon, and Nunkoo-Gonport (2013) argued that some learners were challenged with an array of linguistic difficulties in their learning process. Ibrahim (2001:132) maintained that "there may be a challenge in the lack of LoLT proficiency among learners and teachers". Participating learners expressed consensus about the need to be competent in using LoLT to read, communicate, write, collaborate, and then apply computational skills so as to solve word problems. Yet these learners had to learn MWPs at the same time as trying to learn the LoLT.

Some of the participating AILs requested that the teacher not ask them to answer questions during class discussions because they were afraid or hesitant to speak in English. One of the teachers agreed that such learners need participate only if they felt comfortable. One interviewed teacher, Mr Roca from school B stated that: "*One of the African immigrant learners requested that I should excuse her from explaining or presenting in front of the class as she was shy and had problems in speaking English".* These findings were collaborated with the results from interviews conducted with AILs when some of these learners confessed that they were afraid of going to the board to present their work because of their low or lack of proficiency in the LoLT. During classroom observations, I observed one immigrant learner refusing to present on the board as requested to do by the teacher, who realized that the learner was uncomfortable and asked another learner instead. These findings show that some participating learners struggled with communication in the LoLT; as supported by Morse (2005), Adelman and Taylor (2015) who noted that immigrant learners attend schools where they are racially and ethnically segregated, and linguistically isolated. Participating teachers reported that the LoLT needs of AILs posed their greatest challenge in teaching MWPs.

Classroom observations showed that some teachers did not want other learners to ridicule AILs when they made mathematical mistakes; protecting them from exposure so that these learners could prepare to be able to present to the class when ready. This approach, however, could cause the learner to be more uncomfortable since he or she could be the only one not presenting. A teacher of Financial Mathematics reported that AILs were faced with severe problems in learning MWPs both at home and at school which showed that the LoLT became a learning barrier, and that these learners had difficulties understanding the LoLT as well as the mathematics concepts being taught. One of the AILs, Chinjo, who was interviewed soon after classroom observations, stated that he was not able to contribute during classroom discussions because he could not communicate properly and had limited understanding of the LoLT. Mr Roca**,** when interviewed, noted that AILs did not learn MWPs at home because of low LoLT

proficiency. One of the learners stated that it was only at school where they spoke, wrote, and read mathematical English. These findings are in line with those of Latu (2005) who found that learners were confronted with, and had to deal with, a range of linguistic difficulties when learning mathematics. One of the interviewed teachers, Mr Maomanii from school B, had this to say: "*All teaching activities are conducted in English, which sometimes result in these learners experiencing limitations in language that result in limitations in learning*". These findings suggest that there should be support for immigrant learners in learning mathematics; the sooner these learners were assisted in using the LoLT in mathematics, the better they could appreciate the importance of learning MWPs. As long as AILs have weak understandings of the LoLT, they may find it difficult to manipulate MWPs as propounded by the NCTM (2009).

Learners were found to be actively negotiating their multiple roles and identities in the classroom even when they appeared passive or withdrawn. Yet one participating learner, Muthuli from school A, stated that: "*From my own experience, if anyone could have visited our class he or she could say I was a very quiet leaner but, I could not say anything as I could not speak the English and was not able to participate fully in maths class ".* These results show that some learners found LoLT to be a barrier. In support of this revelation Choi, Lim and Ani (2011:8) stated that when learners are faced with mathematics problems that require the use of active language skills, they have difficulties in understanding new academic terminologies, mathematics concepts and communication with teachers and other learners. In this study most AILs stated that they had challenges in using the LoLT in learning of MWPs.

Classroom observations confirmed the convention that in the South African education system, immigrant learners are routinely placed in English-only classes; often because schools lack teachers who can speak and teach the home language of these learners, such as French, and who could then use CS to support the LoLT. When AILs were placed in English only classes in SA they are often taught by non-native English-speaking teachers who struggled with the LoLT (Vandeyar, 2010). This added impediment increased the challenges faced by AILs since they were supposed to acquire academic mathematics knowledge and literacy skills simultaneously. Academic and literacy skills are well developed if the learners' first language is used in conjunction with the second language (Cummins et al., 2012). Freeman (2009:35) stated that: "the language acquired by learners using their first language makes the input they hear and read in English much more comprehensible".

African immigrant learners had special difficulties with the mathematics vocabulary used in MWPs such as the term *annulus*. For instance, one of the teachers observed asked learners to calculate the area of the annulus for two circles of radii 7cm and 15cm. Learners were confused with the word "annulus" despite the fact that they knew how to calculate area of a circle. One of the interviewed learners, Muthuli from school A stated that "*The language and vocabulary used in mathematics is confusing me, it is difficult to understand as there are a lot of new words or vocabulary*". These findings are in corroboration with those of Powel and Nelson (2017) and Swan (2018) that vocabulary knowledge is an important aspect in solving word problems. Brown et al. (2006:157) note that "even when learners had some prior knowledge of the mathematics, the mathematical language is a major barrier to manipulation of the mathematics word problems". One learner, Gurazzy stated that: *"I was very good in mathematics in my country, but, now I am performing poorly because of the language (English) I am using".* Janice stated that *"I like mathematics but the language we are using is difficult as compared to the one used in my previous country".* These findings revealed that African immigrant learners' knowledge of the subject content was obstructed by the LoLT barrier in the learning of MWPs and rendered them less competent. It was noted that AILs were not assisted with programmes that could assist them transcend well into the new education system in terms of LoLT development. In the USA it was found that "Some districts offer newcomer programmes for recent immigrant learners to help them in some basic survival English and become acquainted with the new learning culture" (Freeman, 2009:47). In this study the length of time AILs were in SA, the amount of schooling they had had in their home countries and the kinds of assistance they received in South African schools, seemed to retard their progress in gaining LoLT proficiency. In support of the above findings, Vandeyar and Vandeyar (2012:162) stated that "attempts were also made to learn English, not only to find a sense of belonging but more importantly to enhance understanding and learning, since both teachers and students only spoke English during lessons".

One teacher, Mr Maomanii, stated that:

> *These learners seem as if they are in lower Grades as they are not understanding certain mathematical concepts due to their lower LoLT proficiency despite the fact that they can communicate socially and this is a challenge for me to include them fully in the learning and teaching process.*

Similarly, Mrs Mwesto described the situation in her mathematics classroom as follows: "*The African immigrant learners I am teaching are struggling a lot to learn English and algebraic word problems which result in them being left behind during my lesson*". These findings are in

line with those of Hewitt-Bradshaw (2013) who pointed out that the language used for teaching and learning could either empower or exclude learners in the learning process. Ms Mdamanest stated that: *"I had no experience of teaching different learners from different countries, I was unable to cater for all immigrant learners as they were unable to communicate well in the LoLT".*

It was apparent that LoLT acquisition constituted a major challenge for the inclusive learning environment; making it difficult to successfully achieve the requirements of South African inclusive education policy; education for all regardless of nationality (DoE, 2011). According to the DoE (2011:5), the general South African curriculum advocates that: "Inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen if all learners have a sound understanding of how to reorganise and address barriers to learning and how to plan for diversity". The results of this study revealed that AILs needed to understand the LoLT before they could learn the MWPs.

4.4. Learning time for immigrant learners

Some teachers reported that they encountered major challenges in teaching AILs because these learners had problems in understanding mathematics concepts delivered in English as LoLT. Mr Erdan from school A postulated that:

> *These immigrant learners need more time to cope with the language and mathematics content, they waste time for local learners therefore, we are disadvantaging citizens by trying to assist these foreigners, and I think it is better to look for a special school for foreigners.*

This notion suggested that immigrant learners were regarded by some teachers as a burden to the learning process and that the solution was to have separate schools which could cater for these learners. Web and Web (2008) found that teachers in the Eastern Cape were doubly challenged in school classrooms. First, they had to grapple with their learners' lack of competence in English (LoLT) and secondly, they had to impart content knowledge or mathematics concepts. The situation in the Eastern Cape was better than in my study area since learners and the teacher shared a common language (IsiXhosa) and used CS; while AILs were taught by South African teachers who did not understand African immigrant learners' home languages. If teachers and learners share a home language, teachers can assist AILs in explaining mathematics concepts in a better and simpler way by using CS. Lave and Wenger (1991:46) asserted that "the power of language in this instance leaves the learners in the position

of the disenfranchised as they are denied access not only to English but also to sense-making opportunities for learning, as they are not the insiders in the communities of practices of academic discourse". Participating AILs experienced assimilation problems because their teachers did not explain for understanding as stated by Danest that "*Our teacher speaks very fast and ignore us and I did not understand him. Our teacher did not tell us the meanings of big words".* The teacher did not provide learners time for mathematical talk which allows mathematics language development and articulation of individuals ideas. The teacher stated that she needed to move fast in order to cover a considerable amount of material (content) as required by the DoE. The teacher was concerned about covering work without considering whether learners understood the content. These findings concurred with classroom observations in this study that some teachers were overloading learners with content without emphasizing understanding. The teacher needed to assist learners by breaking content into smaller portions and placing emphasis on important mathematical terms such as allowing learners to read a question repeatedly and to say what the question mean (reinforcing reading for understanding and comprehension). For example, the teacher asked learners that: *Calculate the sin A if tan* $A = \frac{5}{12}$ *of a right angled triangle*. There was no reinforcement to check whether learners understood the content under discussion. The teacher should have slowed down and used a pace that was appropriate for these learners; by providing enough time for learners to respond and so understand the concepts. Teachers need to assist learners by explaining meanings of new words (mathematical vocabulary) as suggested by Paul, Gregory, Elizabeth and Karen (2015) so that learners can acquire the language of mathematics, LoLT, mathematical terminology and vocabulary such as *hypotenuse, adjacent, opposite and sin*. Sfard (2009) emphasizes that communication in mathematics needs to be taught through mathematically enriching techniques such as visual representation of MWPs. The teacher may allow learners interact with each other through use of dictionaries and word wall to search for meanings of knew mathematical vocabulary (*sin, hypotenuse, adjacent and opposite, tan*) or illustrate using diagrams to answer the example above. During classroom observations, one teacher was seen making conceptual connections to help learners use proper mathematics language through the use of key words in MWPs. This teacher's style of teaching probably led learners to understand the meaning of mathematical concepts better. For example, the teacher used a word bank; providing a materially rich classroom: having more reading materials displayed on the wall. One learner, Janice**,** stated that:

> *Our teacher has a lot of reading material in his classroom. During lunch or break we stay in his class reading the information on the charts and walls. There are*

> *examples, pictures and mathematics stories. It is so interesting; I love mathematics, even if it is difficult for me with some of the big words.*

Slavit and Slavit (2007:6) pointed out that:

> *Helping students brainstorming the meaning of technical words and expressions might unveil potential connections between the meaning of the word, the learners' language background and the mathematics register. This could assist learners to be able to differentiate everyday meaning and mathematical meaning of words in mathematics word problems.*

Teachers can assist learners through using their languages and cultures as reiterated by Slavit and Slavit (2007:7) when saying that:

> *Even teachers who do not speak an English Language Learners' home language can afford opportunities for learners to access books, hand-outs, websites in their mother languages or working with a peer or teaching assistant versed in the home language of the learners.*

Although South African born learners often face similar challenges during their learning of MWPs, they are likely to enjoy the advantages and comfort of being in their home country, having a better understanding of how to meet their challenges in a different and more effective way than available to AILs.

Despite the fact that African immigrant learners' English proficiency was improving in the course of their studies, they experienced frustration due to difficulties in providing their explanations and reasoning; on how they arrived at the correct solution while their new classroom norms emphasized the use of mathematical language via LoLT. African immigrant learners with low LoLT and mathematical language proficiency, faced challenges when dealing with problem solving; particularly where reasoning and communication skills were required. In these situations of solving MWPs there is a need to use academic knowledge or orthodox mathematical language. African immigrant learners had difficulty in speaking the LoLT; which meant that there was a need for "comprehensive input" (Martiniello, 2008). In such situations, teachers need to convey information in a manner that makes learners understand better. Teachers could use gestures or pictures to promote learner understanding; by linking new ideas with prior knowledge. Teachers need to scaffold instructions and provide multiple representations of concepts (Deussen et al., 2008). Lack of language proficiency in LoLT and communication barriers in a new school were major challenges to AILs in this study: AILs

preferred to have linguistically competent teachers from their countries of origin; since these learners grew up without using English either as a language or a learning subject. This observation is supported by APA (2012) who claimed that learners who grow up in non-English speaking homes enter schools challenged with acquisition of LoLT or English in this context.

4.4.1. Classroom observations: Teaching of mathematics word problems

Mathematics word problem: *Five Grade 10 learners contributed money for a farewell party. First learner contributed* $\frac{1}{12}$ *of the total amount, the second learner contributed R10,00 more than the first learner, the third learner had R2,00 more than what the second learner had contributed, the fourth learner had doubled what the third learner contributed and the fifth learner trebled what the fourth learner had contributed. How much money did these learners contributed towards their farewell party? Leave your answer in a simplified algebraic form.*

Solution

Mr Erdan:	"*Who can read the question for us"?*
Class:	*Silent!*
Mr Erdan:	*Danest*
Danest (AILs):	*Silent*!
Mr Erdan:	Anyone to please?
Gumaka (AILs):	*Read but made mistakes in pronunciation and skipped some words as she hesitated to read*.
Mr Erdan:	*"Thombololo"*
Thombololo (SA):	*Read fluently to the class.*
Mr Erdan:	*Re-read the question and asked for interpretation*.
Katso (SA):	"*I think we need to group all the money contributed together"*.
Mr Erdan:	"*We cannot start from there; we need to do something before we group the money".*
Mr Erdan:	"Ema *can you give us the solution"*.
Ema (AILs):	*Kept quiet and felt uncomfortable*.
Mr Erdan:	"*Danest, can you explain and give us the solution*".
Danest:	*Remained silent and confused*

.

The teacher decided to give learners a solution because the learners seemed incapable of giving him the correct solution. Learners had to copy the solution without understanding.

Let us make the total amount of money contributed by learners be x,

$$The\ first\ learner = \frac{1}{12} \times x = \frac{1}{12}x$$

$$The\ second\ learner = \frac{1}{12} \times x + 10 = \frac{1}{12}x + 10$$

$$The\ third\ learner = \frac{1}{12} \times x + 10 + 2 = \frac{1}{12}x + 12$$

$$The\ fourth\ child = 2(\frac{1}{12} \times x + 12) = \frac{2}{12}x + 24$$

$$The\ fifth\ child = 3(\frac{2}{12} \times x + 24) = \frac{6}{12}x + 72)$$

$$Total\ amount\ contributed = \frac{1}{12}x + \frac{1}{12}x + 10 + \frac{1}{12}x + 12 + \frac{2}{12}x + 24 + \frac{6}{12}x + 72$$

$$Total\ amount\ contributed = R\ (\frac{11}{12}x + 118)$$

It was noted during classroom observations that the teacher did not use a variety of teaching styles to promote thinking or logical reasoning but used an algebraic approach only. Learners were not really given an opportunity to explore independently. The teacher provided learners with solutions prematurely; without allowing them to think critically or find solutions on their own. Enough waiting time was needed to be given to learners: they were being spoon-fed without knowing the purpose of doing certain procedures. When interviewed, Mr Erdan stated that: "*These learners are not able to give me correct solutions because they cannot understand English the LoLT which is a major challenge I have*". The teacher reported that AILs struggled to read and interpret the question, which was a great challenge for them when answering MWPs. These findings showed that the teacher underestimated the learner's cognitive abilities to solve problems and they also radiate prejudice about the learners' mental abilities. A learner, Ema, commented after the lesson that: "*I cannot understand mathematics word problems but can do better in other areas like simplify, solve equations as I am not good in English and I was not going to school for a long time before I came to South Africa".* These views expressed by the learner point to lower order issues dealing with procedures and algorithms; instrumental learning and teaching. In a more extreme context, Brown et al. (2006:159) reported that: "Young Sudanese refugees had severely interrupted or no substantive schooling, as a result many of the refugees had little or no literacy in either a first language prior to arrival, they may have little knowledge of the routines of school".

After observing Mr Erdan in the lesson above, 2 more AILs were interviewed who reported that they had not understood the question and the solution given by the teacher because of the LoLT and the mathematics terms used. As seen from the lesson above, some learners were unable to read the MWPs. Danest corroborated this point: when asked about his experiences with the MWPs, he stated that: "*I had a problem with the English and the words '**10 more than'**, '**2 more' 'double' 'trebled' and 'simplified algebraic form**' as written in the above question)"*.

4.4.2. Classroom observations

Mathematics word problem: *If a straight iron bar is leaning against a building, and the distance from the bottom of the iron bar to the building is 16 ft.* ***less than*** *the length of the iron bar, how high up the side of the building is the top of the iron bar if the distance is 2 ft.* ***less than*** *the length of the iron bar?*

Solution

Let x *be the length of the iron bar,*

$x - 16$ *the distance from the bottom of the iron bar leaning against the wall and*

$x - 2$ *be the height of the building to the top of the iron bar.*

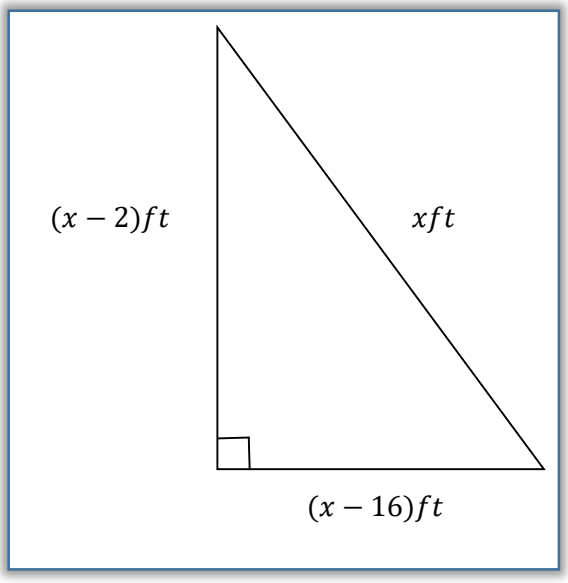

Figure 4.2

By using Pythagoras's theorem

$h^2 = x^2 + y^2[Pythagoras: 90° \overset{\Delta}{\rightarrow}]$ *Then substitute in the equation to solve for* x. *The meaning of* x *is changed for meaning the length of the iron bar.*

$$x^2 = (x-2)^2 + (x-16)^2 \; Pythagoras: 90° \overset{\Delta}{\rightarrow}$$

$$x^2 = x^2 - 4x + 4 + x^2 - 32x + 260$$

$$0 = x^2 - 36x + 260$$

$$0 = (x-26)(x-10)$$

$$x = 26 \;\; Or \;\; x = 10$$

$$Since\ x = 10ft\ then\ the\ distance\ from\ bottom\ of\ the\ ladder\ to\ the\ wall$$

$$would\ be\ 10ft - 16ft = -6ft\ which\ is\ imppossible.$$

Therefore, x cannot be 10 because it is less than 16. So the length of the iron bar is 26 feet and the distance up the wall is 24 feet.

Reasoning by using real-life situations was achieved by 1 out of 14 AILs when finding the length of the iron bar and the distances from bottom of the wall to the top of the iron bar.

Nine out of 14 AILs were confused by the phrase "**less than**" and the units "**feet**" which they were not used to. Learners did not think of using diagrams or construction to represent the word problem diagrammatically or visually which added a challenge to solving the problem. Yet the teacher was able to take learners from one problem solving step to the next by explaining the required steps; from simple to complex. The teacher relied on the mathematization approach as the teacher and learners engaged in using mathematics concepts bringing reality to learners through practical illustrations (Rosales, 2015). The teacher faced challenges with some AILs who had difficulty in applying the theorem of Pythagoras, and factorisation of the trinomial. The teacher had to re-teach these concepts; to assist the learners. The observations showed that some AILs appeared to lack prior knowledge of some of the relevant mathematics topics and mathematics vocabulary such as *Pythagoras Theorem*, *equations and trinomial*, the use of words *right-angled triangle, hypotenuse, as well as conditions to use Pythagoras Theorem*. The lack of mathematics language and vocabulary knowledge by AILs hindered their learning of

MWPs. Some of the AILs may not have previously covered these concepts in their home countries, indicating a troubling gap when transitioning from one education system to another.

African immigrant learners showed facial expressions of being left out during the lesson. Some presented a bored look, some looked indifferent and uninterested. Some of the observed teachers employed a variety of teaching methods to increase involvement of all learners in the learning and teaching process. These teachers made use of group work, pair work, and individual work and class discussions. Some of the teachers observed gave learners ample time to solve the question. These teachers acted as facilitators and created an environment conducive to collaborative learning. One South African learner presented the solution on the board and involved other learners. The teacher asked leading questions such as: *Can you explain what the question mean? Can you explain how you come to the final answer?* This inquiry enabled learners to read and explain their problem-solving steps to other learners. Twelve out of 14 AILs showed limited use of LoLT and prior knowledge; which suggested that they had not been exposed to some of the concepts under discussion, such as basic trigonometry, factorisation of quadratic equations, and might have been challenged by the language used in mathematics classes. Different countries have different focus areas in terms of curriculum coverage and teachers need to conduct diagnostic or baseline tests before teaching learners, especially newly arrived ones. One interviewed teacher, Mr Erdan, stated that: "*It is difficult to find participant learners' level of understanding as I do not have any document that shows these learners' level of education".*

Some learners from Somalia were challenged by the LoLT of the new country. Abdullah stated that: "*I had a "double trouble" because my mathematics was bad, English is bad because I can't understand some English words since I learned in Arabic in my country*". Another learner, Mubarak stated that "*Mathematics here is difficult because I am using English"*. These responses showed that these learners had problems in grasping the mathematics content when expressed in English: "*Mathematics here is having a lot of words and not solve for x, but you have to read and read to get the answer, but I guess."*(Ababa). It appeared that these learners could not have been exposed to learning MWPs in their countries of origin, which compounded their difficulties in dealing with MWPs or topics that involved considerable reading. In this study AILs had language acquisition issues and felt alienated in mathematics classes. Some teachers avoided dealing with challenges faced by AILs. Yet teachers should know that: 'good teachers show up regardless of the behaviour, academic skills, or language proficiency of learners (Sriraman & English, 2010).

4.5. Mathematics language

Some of the interviewed teachers stated that it was difficult for AILs to acquire academic mathematical language since these learners were faced with the double challenge of (i) learning a new LoLT as well as (ii) learning new mathematical content involved different mathematical language from that they had known before. The observation of this double challenge is supported by Carrier (2005), Slavit and Slavit (2007), Web and Web (2008), Setati (2008) and Cummins et al. (2012) who all noted that English language learners face two tasks at the same time when learning new LoLT (English) and new mathematics language (academic language). Teachers in this study were challenged by the dual focus upon mathematical concepts and mathematical academic language. Teachers need to be cognizant of the linguistic demands of their lessons and how to address those demands explicitly during instruction; so that learners can fully participate in the teaching and learning process (Setati, 2008; Rosales, 2015). One interviewed teacher, Mr Maomanii, explained:

> *I have seen that some immigrant learners struggle with mathematical language which is so specialized (mathematical technical terms and vocabulary) such as 'degree of a polynomial', root of the equation' and 'asymptote'. I have decided to have word banks and group discussions after school for them to collaborate by sharing knowledge with each other.*

In support, Slavit and Slavit (2007:6) argued that: "Mathematics teachers must also develop specialized and technical vocabulary, which are words and phrases specific to the mathematical content under discussion". Another interviewed teacher, Mrs Muchova, stated that: *"I find it difficult to try to teach both LoLT and mathematics word problems to these learners especially mathematics academic language*". These findings revealed that teaching of mathematics does not use specialized vocabulary but relies upon words and phrases in different ways than in everyday usage. Holtman et al. (2011) noted that learners find it difficult to manipulate MWPs when expressed in non-real-life situations.

Classroom observations showed that some teachers did not provide learners with opportunities to read, or to think on their own; so as to understand MWPs. Teachers did all the reading and extracting relevant information for learners; with learners being mostly passive. Learners then had few to no opportunities to develop greater insight and critical thinking. Learners were dependent on the teacher which might have contributed to them losing interest, becoming confused or withdrawn from participating. Teachers were not using mathematics language

frequently and consistently as they were using direct questions instead of open ended questions that promote learners to think critically in a more focused mathematization process (Luckenbill, 2018). Teachers sometimes seemed to avoid engaging learners in the process of problem solving by prematurely giving solutions to copy from the chalkboard. From classroom observations, learners were often not afforded a chance to grapple with the question through discussion with peers or by developing their own strategies. Peer discussions assist or promote reasoning and critical thinking where learners can relate the mathematics content to their day-to-day life and manoeuvre the questions (Viseu, 2012). Some teachers were observed reading and writing data or information on the blackboard and asking learners to do the numeric calculations themselves in an effort to avoid explaining contexts and words. These teachers were promoting rote learning and memorisation of information without allowing learners to synthesise the MWPs or evaluate or validate their solutions, which would have enabled learners to become better mathematics problem solvers. In corroboration of these observations, Jan and Rodrigues (2012) noted that teachers should realise the importance of problem solving together with language by reinforcing more learner participation in using mathematics language rather than spoon-feeding learners for the purpose of mere exercise completion.

By avoiding rote learning, creativity and critical thinking would be promoted, which are essential aspects in solving word problems (Sriraman & English, 2010). Learners should be assisted to develop conceptual understanding of concepts rather than use rote memorisation strategies by making certain that different aspects such as mathematics language, concepts and content are given due consideration during the teaching and learning process (Jan & Rodrigues, 2012). Although the mathematical language may be a challenge for learners, teachers should make a deliberate effort to use the mathematics language since it is critical for these learners to move from everyday language to the more formal language of mathematics. Indeed, learners are required to develop the correct use of mathematics language (DoE, 2011,).

Jan and Rodrigues (2012:156) emphasised that "teaching mathematics word problems does not only deal with symbols, numbers, procedures and rules, rather the language of the text is an important aspect as well". During classroom observations, AILs in this study were using any formula that became available to them; without much consideration or reasoning for using such methods. Sepeng and Madzorera (2014) concurred that learners had difficulties in understanding word problems and were confused when having to select appropriate operations to be used. One of the learners interviewed, Rana, articulated that "*The mathematics language used in the mathematics word problems is difficult, sometimes it confuses and you do not know*

which method to use". Another learner, Ema, claimed that she took numbers from MWPs and multiplied without understanding the meaning of the MWPs. Mr Erdan concurred that "*immigrant learners have a tendency of memorizing formulas that come into their mind first and use them to solve word problems*". In support of the views above, Warren, Young and de Vries (2007) stated that learners guessed and used any mathematical operations they came across or thought were correct. These findings revealed that some of the learners did not consider whether there was basically any real connection between the problem context, the identification of mathematical information contained in the problem and the relevant formula to be used to solve MWPs.

Some of the teachers were keen to assist learners who were challenged by mathematical language. Mrs Ihoe stated: "*I try by all means that my learners understand the mathematical vocabulary, language and terms not by nodding but by actually understanding and comprehending through tasks".* Through the use of conversational language, learners can share important information and develop and acquire mathematical (academic) language. African immigrant learners in this study needed to understand the meanings of mathematics language and vocabulary so that they could manipulate word problems successfully (Sepeng & Madzorera, 2014).

Some interviewed teachers stated that they gave learners opportunities to explain their mathematical procedures when solving MWPs. For example, from classroom observations one learner explained the steps she took when solving two-dimensional trigonometry word problems. Yet some teachers complained about the time allocated for teaching and coverage of the work schedules according to the DoE requirements. These challenges resulted in AILs lagging behind and lacking motivation because they were challenged in examinations with new vocabulary which they had not been taught or exposed to by their teachers. Ema commented that "*I became lost when answering mathematics word problems in the mid-year examinations as I can't read well and understand mathematics word problems*".

Participants' responses indicated that they appreciated that mathematical language was different from other languages such as English, IsiXhosa and Afrikaans. Mathematical language is a specialised language with its own meanings that are different from everyday language (Ni Riordain, 2011), such as *rectangular, parabola, exponential function, and axis of symmetry*. Kotsopoulos (2007) asserted that learners encounter challenges when trying to understand the terms used in MWPs when these are similar to everyday words but have different meanings

when used in mathematical context. For example, a question: *What is the volume of a tank of radius 50cm and height 62cm*? There is *volume for sound* and *volume for capacity* which could confuse learners. African immigrant learners reported that mathematical vocabulary and language hindered them from performing well in MWPs for example, the questions they were given by their teacher: *What is the time taken to run 200metres per minute? What is four more than a number? What is ten times a number?* Most learners reported that they were not able to provide correct solutions to the questions above, due to the mathematics vocabulary used. Most participating learners had problems in extracting relevant information as well as in understanding the meaning of the MWPs. These findings were supported by Moreira (2009) that learners' mathematical reasoning was hindered by limited language proficiency and lack of vocabulary knowledge.

The findings above imply that learners should be encouraged to use mathematics language extensively, even if they make mistakes and teachers should always be trained in mathematics language. Teachers need to ask questions that allow mathematical talk, which will inspire mathematical thinking skills through interaction (Luckenbill, 2018), so that learners can be better problem solvers. As Slavit and Slavit (2007:7) advised, "learners need to be encouraged to ask questions and take risks, as making mistakes is a part of learning". Teachers need to provide opportunities for immigrant learners to explain their mathematical procedures immersing learners in rich mathematical language; so that they could acquire the needed mathematical vocabulary and language. This linguistic acquisition could result in better learner performance in solving MWPs. Although multilingual learners are generally confronted with meeting high academic standards, AILs face the additional intricacies of having to learn and use high-level academic mathematics language when they study challenging content in a new LoLT. It was observed that learners who did not grow up being exposed to English (LoLT), were academically disadvantaged and frequently required translation from peers who spoke their native language. This showed that the LoLT played a crucial part in academic progress in mathematics.

Some of the teachers reported that they found it difficult to explain mathematical language to learners in a simple way. Mrs Mwesto stated that: "*I do not know how to simplify mathematical terms to learners in a better way for them to understand easily*". Some interviewed teachers had difficulties in understanding MWPs themselves. Mr Watso stated that: "*I did not train for mathematics but due to a shortage in the Mathematics department I am teaching mathematics*

instead of IsiXhosa and Mathematical Literacy it's really difficult for me to teach this subject". Classroom observations corroborated this teacher difficulty.

Some learners were not able to comprehend language-rich word problems and apply their existing knowledge; as noted by Abdullah: *"I know how to multiply the numbers. I did not know the meaning of the word problem that I should multiply these numbers*". Abdullah seemed to have felt frustration when his poor understanding of MWPs, insufficient development of fundamental mathematics concepts as well as symbol manipulation became more compounded when he was confronted by algebraic expressions. Latu (2005:27) contended that: "if a child's aim is to achieve success in mathematics, but she or he is continually hampered by reading problems, frustrations and lessening of self-expression is likely to occur".

4.6. Mathematics word problems

Choi et al. (2011) found that poor LoLT proficiency created a major obstacle for immigrant learners in the solution of word problems. Deussen et al. (2008:8) stated that: "mathematics word problems are particularly challenging for ELL's". The learner interviews in this study confirmed that most AILs were challenged in reading mathematics word problems. Ema stated: "*Mathematics word problems are difficult for me. I do not understand them*". These learners lacked appropriate problem-solving techniques, there were also content gaps and limited knowledge in terms of algebra. African immigrant learners lacked appropriate techniques such as reading a question or a statement, thinking critically, analysing, evaluating, and carrying out appropriate computations. They seemed to operate at the lowest cognitive levels of the Blooms taxonomy (Munzenmaier & Rubin, 2013) most of the time. The findings are in line with Nelson's (2002) who observed that, for learners to understand solving mathematics word problems, they need to know why certain approaches work and understand the question under discussion. For example, some questions need diagrams for them to be manipulated while others do not need diagrams as illustrated by the example shown in figure 4.3, 4.4 and 4.5. Similarly, Suarez-Orozco et al. (2009) pointed out that MWPs require learners to read and figure out the mathematical principles before they solve the mathematical problems. African immigrant learners were challenged when faced with specialized and technical vocabulary such as "*function*", "*mode*", "*at least*" used in MWPs. Since MWPs are essential in mathematics, teachers need to teach learners for understanding, as advised by Sajadi et al. (2013:11) who pointed out that: "Word problem solving is one of the important elements of mathematical problem solving which incorporate real life problems and applications'. The DoE (2011) advised that, for a learner to develop essential mathematical skills, he or she should learn to

pose, identify and make decisions using critical and creative thinking and demonstrate an understanding of solving MWPs.

African immigrant learners faced challenges in selecting appropriate mathematics symbols and units such as *ft. (feet)* and *m (metres)* when having a question that have both imperial and metric units when solving MWPs such as: *A farmer has a rectangular field of area* $1032ft^2$ *and perimeter of* $92m$. *Calculate the dimensions of the field*. African immigrant learners were confused with the units and the term *dimension*. African immigrant learners were observed to struggle with reference to operational symbols. For example, some of the AILs knew the symbol × but did not know the English language terms that are used, such as *product, multiplication, and times as a factor.* Another challenge comprised variations in culture in the use of some symbols; for example the use of a comma or a full-stop or period for decimal symbols. In other countries, learners were used to a comma rather than a period for showing place value; for example 10 000.00 for ten thousand instead of 10 000,00. Some of the Somali learners were used to practising mathematics at mosques rather than in the classroom: they used Arabic symbols and their way of writing was also different. Siyepu and Ralarala (2014:334) found that: "the use of signs, symbols, rules and formulae in mathematics confuses students as they struggle to access the meaning of this terminology".

In some instances, learners were confused by special symbols used by teachers in mathematics classes such as ∑ (Sigma notation) and € (Euro currency) because they were different or unfamiliar to the symbols used in their countries of origin. Teachers should explicitly teach AILs and provide them with opportunities to practise articulating their mathematics ideas or concepts precisely. Teachers can assist AILs by anticipating these learners' language needs and work with them to identify misconceptions in the use of mathematics symbols (Deussen et [2]al., 2008). During classroom observations, I found that some teachers were using learner self-talk; whereby learners were encouraged to re-read the word problems for understanding. African immigrant learners were allowed to use self-talk to help them to think through the MWPs. Self-talk assisted them to make better sense of MWPs at hand. Mr Roca pointed out that "*I always allow my learners to read aloud and to re-read the word problems as many times as possible so that they may understand the mathematical language in the mathematics word problems and make sense".* Irujo (2007) concurred that self-talk strategy assists learners to interpret

[2]However, at most quintile 1 and 2 schools where the majority of African immigrants are obliged to place their young, the sheer number of learners in a class makes it virtually impossible for teachers to devote this degree of individual attention.

mathematical language and increases their understanding of MWPs. Some of the teachers were observed to encourage AILs to use diagrams when dealing with MWPs as a strategy to assist these learners to manipulate the questions. For example, in the following:

Mathematics word problem*: A rectangle has an area in square metres. The width is a quarter times the size of the length. Find how long are the length and width if the perimeter of the same rectangle is fifty metres?*

The teacher, Mr Roca, told learners to draw the sketch of the rectangle so that they could make sense of it before they used any formula. Learners were able to manipulate the mathematics word problems with the assistance of the diagram.

Mr Roca:	*"Anyone to draw the rectangle"?*
Janice: (AILs):	*"Yes Sir".* The learner drew the rectangle on the board.

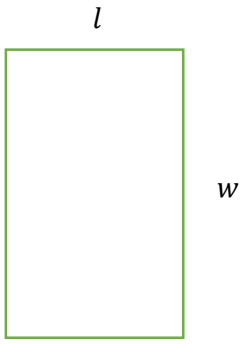

Figure 4.3

Mr Roca:	*"Anyone to label the sides"?*
Chanu (SA)*:*	*Labelled the rectangle*
Ceca (SA):	*"Let us call one side length (l) and another one width (w)".*
Mr Roca:	*"Any suggestions? How do you see this diagram"?*
Gurazzy (AILs):	*"Sir why not using l and b?"*
Mr Roca:	*Why?*
Gurazzy (AILs):	*"Because that is what I know".*
Mr Roca:	*"We use w not b here in SA"*
Mr Roca:	*"Anyone with anything to say?"*
Class:	*"Remained silent".*
Mr Roca:	*"What should we do class?"*

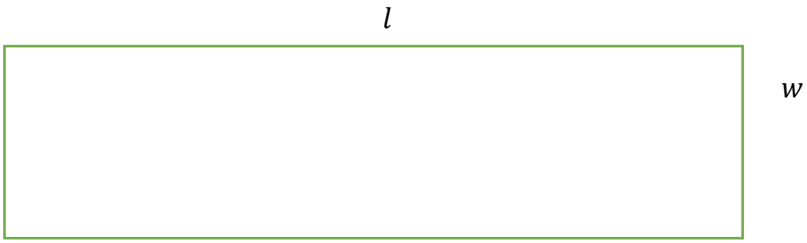

Figure 4.4

Lari (SA):	*"I will try mine Sir" (the learner drew his rectangle (above) and labelled it)*
Mr Roca:	*"Which one is correct"?*
Zona (SA):	*"The first one, I am not sure Meneer".*
Mr Roca:	*"Why do you say it's correct"?*
Zona (SA):	*Kept quiet.*
Mr Roca:	*"But, I would like each person to do yours and solve the question"?*
Mr Roca:	*The teacher finally led learners in class discussions and provided solution after seeing that learners struggled to get the correct answer.*

Solution

Let the length be l and the width be w. Therefore the $w = \frac{1}{4}l$

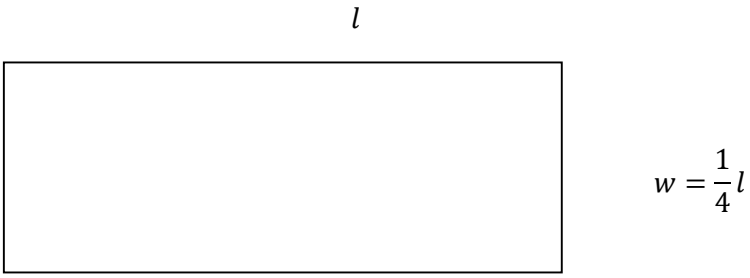

Figure 4.5

$$\boldsymbol{P = 2(L + W)}$$

$$\boldsymbol{P = 2\left(l + \frac{1}{4}l\right)}$$

$$\mathbf{50} = \mathbf{2}(\frac{\mathbf{5}}{\mathbf{4}}\boldsymbol{l})$$

$$\mathbf{50} \times \mathbf{4} = \frac{\mathbf{10}}{\mathbf{4}}\boldsymbol{l} \times \mathbf{4}$$

$$\frac{\mathbf{200}}{\mathbf{10}} = \frac{\mathbf{10}}{\mathbf{10}}\boldsymbol{l}$$

$$\mathbf{20} = \boldsymbol{l}$$

$$\therefore \boldsymbol{length} = \mathbf{20}\ \boldsymbol{meters\ and\ the\ width} = \frac{\mathbf{1}}{\mathbf{4}} \times \mathbf{20}\boldsymbol{meters} = \mathbf{5}\boldsymbol{meters}.$$

The teachers observed did not clarify that w $(width)$ and b $(breadth)$ are the same and are both correct and widely used. All synonyms for distance or length should be introduced to learners: *width, depth, height, breadth,* with words and diagrams. African immigrant learners were left confused, lost, and lacked confidence in their previous knowledge. The teacher, however, did transform the word problem into a diagram making it more explicit and visual for the learners. The question contained irrelevant information, which places extra stress on the language understanding. Generally, some teachers used concrete illustrations: for example, diagrams to remind, and familiarize learners and to facilitate learning so that AILs could understand the mathematical language as well as the mathematical content in MWPs. African immigrant learners were allocated more time to explore and think about the MWPs. Most interviewed AILs spoke about them lacking confidence in interpreting MWPs, lack of guidance from teachers and lack of language proficiency (English). These challenges could be related to their lack of reading and writing skills in English. To overcome these challenges, some AILs stated that they resorted to peers for support since they worked in groups. This finding is in line with Van Manen's (1990) that learners' experiences arise from their lived social contexts: they learn from involving themselves actively with other learners. Anhalt, Farias, Farias, Olivas and Ulliman (2009) found when dealing with problem solving, that if ELL are given time to engage fully and use their concrete experiences, they could distinguish formal from informal mathematics language.

It was observed in class that some of the AILs shut down when they were presented with complex mathematical vocabulary and terms, which manifested as frustration on their faces. The teacher used multiple examples by breaking down the complex terms (mathematics vocabulary) into clear concepts that were understood by all learners. The teacher used the mathematization approach to assist learners understand and manipulate the word problems under discussion through the use of diagrams, a glossary, and learner talk-aloud. This example

of good teaching was in line with the requirements of the DoE (2011), that learners need to develop essential mathematical skills such as number concepts, number vocabulary, calculation and application skills.

4.7. Comprehending mathematics concepts

Even if they were able to read, most AILs interviewed had difficulty in comprehending the concepts contained in MWPs. The difficulties they experienced were due to their inability to explain or speak; to express themselves coherently their command of the English language. This resulted in misunderstanding of MWPs. Mr Watso had this perception: "*My major problem is that mathematics word problems have specialised language which demands mathematical comprehension when finding solutions"*. Another participating teacher, Mrs Mwesto stated during the interviews that: *"Immigrant learners are faced with challenges in understanding of mathematical language and they become confused during discussions as some mathematical vocabulary have different meanings in everyday usage such as concepts like* ***function, range and domain****".* Some of the AILs were observed to be unable to express the meaning of the MWPs provided by their teachers because of fundamental misunderstandings of mathematics vocabulary. Mubarak stated that: "*I felt sad that I was unable to understand big words because I do not know this big vocabulary"*.

Simbe noted that:

> *So what is the need for coming to school if I always get zeros in these mathematics word problems? I used to be a best learner in mathematics in my country but, now this topic is giving me problems, other topics are better but mathematics big words are a challenge to me. I hate this topic because it is English only which is a difficult language to me. I am not an English man.*

These findings agree those of Adams et al. (2005) that learners experience challenges with mathematical words that have multiple meanings. Similarly, Morton and Qu (2013) reiterated these findings by stating that most learners in their study were challenged by solving MWPs due to their inability in text comprehension. Pettit (2011) had a different view: that immigrant learners need to communicate mathematically by using technical terms such as mathematicians do, while using everyday language for support. Both teachers and learners were seen having difficulty in forming algebraic expressions or equations for some word problems. This shortcoming resulted in learners not being able to perform the correct calculations and produce a correct solution. The African immigrant learners' present lived experiences in learning MWPs

was different from their past lived experiences or from what they were used to in their countries of origin (Van Manen, 1997). The views of participants' experiences of MWPs showed that some had been used to memorization and rote learning approaches in their countries of origin.

4.8. Using formal and informal language in mathematics

The example below illustrates the use of informal and formal mathematics in MWPs that involve fractions. Mathematics word problem: *A plumber took half an hour to dig a 20m long trench, one twentieth of an hour walking five hundred metres long to work and used the rest of his six hour day long to do the actual plumbing. How long did he take to do plumbing?*

The mathematical language used could be a challenge to learners. For instances, the words "far" and "long" confused learners, because they have different meanings in the formal and informal mathematical languages, and "long" is used to denote distance and time in the question. Confusion could be reduced by providing activities that enabled learners to practise and explore MWPs. Learners provided different solutions such as the ones below according to their understanding of the problems or due to their interpretation of the mathematics language used in the questions.

Some of the learners' solutions:

$$20m + 500m + 6hours = 526m\ long\ (Incorrect)$$

$$20 + 500 + 6 = 526\ (Incorrect)$$
$$20 + 500 + 6 = 526\ hours\ (Incorrect)$$

$$6 - \left(\frac{1}{2} + \frac{1}{20}\right) = \frac{120 - (10 + 1)}{20} = \frac{120}{20} - \frac{11}{20} = \frac{109}{20}\ hours$$
$$= 1hour\ 49\ minutes\ (Correct\ solution)$$

African immigrant learners were seldom able to solve the above MWPs and confused the operations by guessing, resulting in wrong solutions (as in the first 3 answers above). It was found that these learners were confusing the operations and resorted to guessing the solutions. In their study of problem solving, Anhalt et al. (2009) found that if ELLs were given time to engage fully and use their concrete experiences, they were able to distinguish formal from informal mathematics language. The findings revealed that the teacher did not provide enough

opportunities for learners to use mathematical language to promote critical thinking for problem solving. Using concrete experience could assist learners to distinguish between formal and informal mathematics language.

For another example:
Mathematics word problem: *A farmer wanted to irrigate his fields in the following proportions: one fifth of the rice field and three sevenths of the maize field. What is the amount of land that was not irrigated by the farmer?* Some learners added the numerators and denominators while others critically read the MWPs and came up with accurate answer.

Learners' Solutions:

$\frac{1}{5}+\frac{3}{7}=\frac{4}{12}$ (Incorrect)

$$Correct\ solution:\quad 1-\left(\frac{1}{5}+\frac{3}{7}\right)=\frac{35-(7+15)}{35}=\frac{35}{35}-\frac{22}{35}$$
$$=\frac{23}{35}\qquad by\ using\ fraction\ bars$$

The first solution, revealed that knowledge of fraction rules and properties were non-existent. The teacher had to revise basic fraction rules and properties: for example, that one can add numerators or subtract if the denominators are the same.

There is need for learners to make connections between everyday mathematics and formal mathematics. Anhalt et al. (2009) advised that teachers should avoid teaching by telling because it had a negative impact. Teachers should rationalise why certain procedures hold true and emphasize the use of mathematical vocabulary and language for learners to see and understand how mathematical ideas and concepts connect and build upon each other (Luckenbill, 2018). Some learners' academic English (mathematical language) may not be developed properly. Teachers need to be facilitators or learning partners and guide learners when they are in the act of finding solutions, by using appropriate questions that engage learners in mathematics discourse of the lesson under discussion.

There is a need for teachers to create and deliver MWPs lessons that are meaningful for learners. When teachers deliver lessons that use real-life situations, they could foster a positive attitude,

increase enjoyment and enhance the learning of MWPs. Pacaya (2005:30) agreed that "teachers should strive to relate mathematics activities to learners' lives if they are to be motivated and engaged". Teachers could assist immigrant learners to engage actively in academic discourse in a meaningful manner. Teachers could help immigrant learners by engaging in collaborative teaching. Lesson delivery could be improved by taking learners' needs into consideration since collaborative teaching promotes learner interaction, engagement and allows for professional critiquing.

Most learners were found to lack linguistic development as well as the conceptual knowledge needed to solve MWPs. Mubarak stated that: "*Word problems are difficult for me because I cannot understand the language used as I confuse the words used like* ***more than*** *and* ***quotient***". Learners were not able to comprehend the word problems since they were confused by the complexity of the language used. For AILs to solve MWPs they need to understand the mathematical language used so as to identify the mathematics relations which they are to convert to abstract symbols. In support of the above views, Irujo (2007:327) posited that learners find it difficult to solve MWPs because "word problems are artificial situations described using mathematical language of problem solving, which makes it difficult to use reading skills learned in other contexts to help learners understand the problems".

Teachers of AILs need to be fully conversant with mathematical academic language and be able to use it proficiently in their classrooms. According to Martiniello (2008), teachers need to understand the importance of explicitly teaching mathematics language to promote learners' understanding. Word problems are difficult to solve when linguistic forms used do not map onto a person's existing conceptual knowledge (Cummins, 2007). Word problems are found in the DoE assessment tasks and make up an important aspect of the SA curriculum. Many learners have challenges in manipulating mathematics problems. Several teachers reported that it was difficult to develop learners' abilities to solve MWPs because the task becomes increasingly frustrating. Bernardo and Calleja (2005) agreed that solving MWPs is an integral part of mathematics education in most parts of the world since problem-solving provide learners with opportunities to relate mathematics knowledge and skills to real-world circumstances.

4.9. Prior knowledge

African immigrant learners' experiences revealed how their past learning experiences influenced their current and future learning experiences in the learning of MWPs. Most learners believed that teachers were responsible for explaining everything to them and that they should

always ask for assistance or guidance when they had challenges or needed more attention from their teachers (Deussen et al., 2008). Some AILs were used to having teachers closer to them and having good teacher-learner relations. Their past experiences had a direct effect on their present and future learning experiences of MWPs in the adoptive country. As Lube noted: *"Our previous teachers always used to assist us when we had problems, but, now we are having difficulties because this teacher does not explain and assist us, I will fail mathematics".* This observation was congruent with that of Van Manen (1997) that the past learning experiences of individuals influenced their present and would affect their future experiences. These learners did not have proper documentation or authentic progress reports, so there were no linking documents between countries or subjects. In the learners' lived time, their past, present and future learning experiences influenced each other (Van Manen, 1990; Shrestha, 2011). In the changing life world of AILs, what they had experienced in their countries of origin, what they were currently learning and the accompanying shifts in their learning experiences, all impacted upon their notion of positive mathematics self-concepts and self-esteem (Finlay & Molano-Fisher, 2008). However, some teachers' expectations of immigrant learners were low, which could have negative effects on these learners' self-esteem, self-worth, and mathematics self-concepts. Two significant gaps in African immigrant learners' understanding of new concepts were found to be due to (i) lack of previous knowledge and (ii) lack of teachers' knowledge of learners' linguistic, cultural, and mathematical background knowledge. As Mr Roca formulated it:

> *At the beginning of the year I did not know exactly what these learners covered, how they performed previously in mathematics therefore, I did not have their mathematics learning background which made it difficult for me to assist them. I tried to do a baseline assessment to test their basic knowledge so that I could be prepared to teach them.*

Without such information, teachers could not develop effective intervention programs where these were needed. It is essential that teachers set basic assessment to gauge learners' prior knowledge and competences before engaging them with particular mathematics content such as problem-solving of contextual or word problems. Yet not all AILs complained about lack of prior knowledge. Indeed, Gurazzy informed me that he was good at reading and calculating mathematics problems and he even read for me during the interviews. This learner stated that he assisted some of the local South African learners when manipulating mathematics problems. It was found that some AILs could draw upon their funds of knowledge which could be useful

to local learners. This observation was in line with the perceptions of Slavit and Slavit (2007:7) who noted that:

> *All learners come with varied lived experiences and knowledge that often leads to creative ways of solving mathematics problems and immigrant learners bring unique perspectives on concepts or algorithms learned in another school culture or perhaps through a novel context for application of a specific mathematics topic.*

Lavadenz (2011:34) claimed that "learners bring with them funds of knowledge from their homes and communities that can be used for concept and skill development". Due to their lack of previous knowledge, some of the AILs had to meet several challenges in learning MWPs.

From the classroom observations, I found that most AILs had a wide gap between the content taught in their previous countries and the current content in the host country. African immigrant learners were unable to understand some of the mathematics content which had been done in previous grades in SA. For example, some of the interviewed AILs stated that the content they were learning in Grade 10 such as Financial Mathematics, was new to them, and had not been taught in their previous schools. Teachers should be knowledgeable about the newcomer AILs, which they did not seem to be, without taking it for granted that all learners would know all the content under discussion. However, during classroom observations, Mr Erdan, was observed to continue teaching even when learners alerted him that they had not covered the topic in their countries of origin. The teacher continued with teaching, however, he referred learners to revise work for previous grades and ask assistance from their peers. When interviewed on why he ignored learners' needs, Mr Erdan stated that he could not go back and teach work for previous grades because of insufficient time to cover the content for the current grade. This teacher's action demotivated learners and was against the DoE teaching and learning requirements. Teachers should check the learners' previous knowledge through diagnostic (baseline) assessment. Teachers should teach from the known to unknown and not assume that learners already know all the previous concepts to have a clear understanding of their learners' prior learning experiences (Bonenfant, 2012). Use of learners' prior knowledge could provide the basis for learners to interpret new concepts that they may not have encountered previously (Freeman, 2009). One interviewed learner, Chinjo, from school A, stated that: "*We spent a lot of time out of school because we were crossing boarder to boarder on foot until we come to South Africa that is why I cannot understand the mathematics I am learning*". Similarly, Brown et al. (2006) observed that lack of prior knowledge by learners may be attributed to interrupted

schooling; where learners spent their time moving from one place to another before they reached their new country.

To make learning more appropriate, significant, and effective, teachers should use learners' funds of knowledge as in culturally responsive pedagogy, use of cultural knowledge, prior experiences, and drawing upon the performance styles of diverse learners (Coady et al., 2013). Brodie, Zaheera and Modau (2009:20) asserted that "in a constructivist environment learning takes place when the prior knowledge of the learner is restructured and reorganized in a more powerful knowledge structure". Irujo (2007) advised that teachers of mathematics with diverse learners should become familiar with their learners' learning backgrounds in order to make the mathematics curriculum culturally relevant by drawing on the knowledge and resources of learners' homes and communities and so embrace diversity as a significant factor in mathematics classes (DoE, 2014). Moreover, teachers should try by all means to tap into the learners' prior knowledge; by relating topics to learners' lives and experiences so as to connect their background knowledge with new mathematics concepts.

One teacher, Ms Mdamanest**,** made it clear that AILs were unable to cope with the challenge of gaps between the content learned in countries of origin and host country, as illustrated below. Some AILs in Grade 10 were unable to understand the content being taught under financial mathematics. They were unfamiliar with the mathematics terms which had been covered in Grade 8 and 9. Mathematical terms such as *present value*, *future value*, *simple* and *compound interest*, *principal*, and the formulae for *simple* and *compound interest,* were new to some AIL.

For example, Mathematics word problem: *How long an amount of money must be invested for it to double at an interest rate of 8.5% p.a. simple interest? Give your answer in years and months. (14/07/2016).*

Ms Mdamanest:	"*Can someone explain to us what the question is all about*"?
Simbe (AILs):	"*I do not know what the meaning of simple interest Ms is".*
Ms Mdamanest:	"*Anyone to assist in explanation of simple interest class*"?
Mico (SA):	"*I think we should use a formula like what we did last year in Grade 9".*
Ms Mdamanest:	"*Which formula class*"?
Eona (SA)	"$A = P(1 + in)$ no $A = P(1 + i)^n$ $am\ not\ sure\ Ms. I\ have\ forgotten.$
Ms Mdamanest:	"*Which one class*"?

Abdullah (AILs):	*"This information is new to me*".
Ms Mdamanest:	"*Why do you say so*"?
Abdullah:	"*I do not know teacher, I am guessing, I did not do this topic in my country*".
Ms Mdamanest:	"*What did we say about simple interest last year class*"?
Class:	All remained silent.

Without wasting time Ms Mdamanest explained the concept of simple interest and the difference between the two formulae $\boldsymbol{A = P(1 + in)}$ $\boldsymbol{and}$ $\boldsymbol{A = P(1 + in)}$, without explaining how the formulae were arrived at through basic examples/ contexts.

Ms Mdamanest:	"*What does the letters A, P, i and n stands for*"?
Lusanda(SA):	"$\boldsymbol{A}$ $stands\ for\ Future\ value, \boldsymbol{P}$ $stands\ for\ Present\ value, \boldsymbol{i}$ $stands\ for\ interest\ as\ a\ decimal\ and\ \boldsymbol{n}$ $stands\ for\ the\ number\ of\ times\ in\ this\ question\ it\ is\ the\ number\ of\ years\ needed$"
Simbe (AILs):	"*I do not know this topic because the topic is new to me".*
Ms Mdamanest:	"*Anyone with different ideas or who want to add more information*"?
Chinjo (AILs):	"$P = present, A = Annum, i = index\ and\ n = number$"
Class:	Laughing at Chinjo as he give incorrect answers
Chinjo:	Showed withdrawal and shyness in front of other learners.
Ms Mdamanest:	"*We do not have to laugh at each other. He does not know but he tried his best*".
Melusi (SA):	"*P stands for amount one will have at first and A stands for the amount one will have after a certain period*".
Simbe :(AILs):	"*I am lost Ms. This is new stuff to me. I did not do this stuff in my country".*
Ms Mdamanest:	"*Let us substitute in the formula* $\boldsymbol{A = P(1 + in)}$ (without explaining or assisting the learners who clearly lacked prior knowledge)"

Solution

Simple interest: $\boldsymbol{A = P(1 + in)}$

Let the present value be P. Therefore the final amount will be 2P

$$2P = P(1 + in)$$

$$\frac{2P}{P} = \frac{P(1+in)}{P}$$

$$2 = 1 + in$$

$$\frac{1}{0.085} = \frac{0.085n}{0.085}$$

$$\therefore n = 11.764 = 11\ years + 0.764 \times 12\ months$$

$$\therefore n = 11\ years\ and\ 10\ months.$$

From classroom observations it was apparent that, without possessing prior knowledge of financial mathematics, it was difficult for these AILs to calculate the period needed. Through class discussions it was revealed that they were challenged by the language of learning as well as the mathematical language used, the mathematical concepts, prior knowledge, and which formula to use to solve the given word problem. The teacher could have used the key words allowing learners to distinguish which formula to use in this particular word problem. The teacher needed to explain how the formulae were arrived at through basic example or contexts. If the question states simple interest, learners should be able to choose the simple interest formula $\boldsymbol{A = P(1 + in)}$ rather than the compound interest formula $\boldsymbol{A = P(1 + i)^n}$.

The teacher went on to use the formula $\boldsymbol{A = P(1 + in)}$ without explaining how and where the formula were derived or assisting learners who lacked the previous knowledge of financial mathematics. She taught learners how to solve the MWPs mechanically and procedurally, without explaining the reasons for choosing the formula $\boldsymbol{A = P(1 + in)}$instead of $\boldsymbol{A = P(1 + i)^n}$**.** The teacher favoured instrumental (rules without reasoning) rather than relational teaching and learning (Skemp, 1978) because she was content with learners getting the correct answers without reasoning. This showed that the teacher favoured a teacher-centred approach. The teacher did not provide a platform for learners to discuss a solution and give reasons for choosing one of the formulae to apply. Learners were not given opportunities to discover, or explore, or even to be guided in deciding which formula to use. Teachers should provide learners opportunities to have hands-on activities that help them to exploit and explore links between previous and present knowledge (Slavit &Slavit, 2007).

The classroom observations showed that some learners were not involved fully in the lesson delivery. Simbe and other AILs were left out because they did not appear to have any idea about the topic under discussion and mathematical terms like *principal*, *interest*, *period* and *present*. These terms have different meanings in everyday use and mathematics. For example, the term

principal means amount invested or borrowed in mathematics while in everyday use it means a headmaster. In this classroom situation the teachers' planning and use of teaching methodologies did not apparently encompass the needs of all learners equally. Some learners' facial expressions showed that they were confused and lost during the lesson discussion. During classroom observations, Ms Mdamanest was seen to say: *"Guys, if you do not understand the terms used you can go and use the Mathematics Dictionary as well as Grade 8 and Grade 9 text books for better understanding, this material is for Grade 8 and 9 and should be easy to understand"*. This teacher took it for granted that all learners possessed some previous knowledge about the topic under discussions, without considering that some of the AILs lagged behind the South African learners. She did not provide learners with underlying mathematical basics so that they could understand the new content and manipulate the MWPs. During interviews, when Ms Mdamanest was asked why she did not explain to learners the reasons for using the formula $\boldsymbol{A = P(1 + in)}$**,** she stated:

> *I am not comfortable with Financial Mathematics, I also did not do this topic at high school and I did Diploma in Science, at least it is better for these learners because I am guiding them and they should do more practice on their own and I can't reteach the content for previous grades because this syllabus for Grade 10 is very long.*

These findings showed that teachers' enthusiasm and innovation, and the willingness to go beyond what was expected in terms of addressing the learners pressing needs might provide opportunities for all learners to improve their mathematics problem-solving skills. However, teachers' lack of mathematics content knowledge and being overburdened by the curriculum, could affect learners understanding as teachers might tend to teach for examinations using instrumental teaching and learning approach (Skemp, 1978).

African immigrant learners revealed that topics such as circle geometry and trigonometry were new to them and some of the teachers did not assist because they themselves were not fully conversant with these areas and always rushed to complete the topics as stipulated by the WCED. Mr Erdan stated in interview: "*We do not have enough time for extra classes as we are supposed to finish the work schedule according to the requirements of the WCED".*

Correspondingly, immigrant learners might never have heard about some local knowledge because they were new to the local environment. It was found that in other classes teachers tried to use concepts and real-life materials according to the learners' background, to assist

immigrant learners understand new concepts. By being aware of the needs of immigrant learners, some teachers tried their best to assist these learners. However, after the intervention program, these observations were supported by the remarks offered by Gurazzy that: "*Our teacher always uses a lot of examples. He gave us some questions similar to what we did in our home countries, I felt so excited, motivated and valued".* In using learners' real-life examples these teachers triggered learners' previous knowledge to increase learners understanding of new concepts. This interpretation was supported by Jhagroo (2011:8) who noted that "students bring a unique perception of the learning situation that is shaped by past learning experiences". However, these findings disagreed with Suarez-Orozco et al. (2009) who emphasised that most immigrant learners were not having usable previous learning experiences in their countries of origin; this clearly contributed to their exclusion in the learning and teaching process. I found that some of the teachers had difficulty in accepting the prior material (content) learnt by AILs in their countries of origin. However, some teachers tried their best to find learners' previous knowledge through the use of diagnostic tests. Mr Roca explained that *"I always give my new learners a diagnostic test to assess their prior knowledge before I start a new topic. This assists me to know the areas these learners lack or were not taught in their countries of origin*".

The interview and classroom observations showed that AILs grappled with academic literacy, meaning they could not comprehend or read analytically, or synthesise information, or mathematize information from text. Some teachers were unsure of how to respond to this challenge and left it to the school to help in catering for the needs of these AILs. Some of the teachers were observed helping AILs to understand the mathematical language in LoLT through clear explanations of the meanings of the MWPs making clear connections between previous learning experiences and new concepts.

Some of the AILs had limited knowledge or completely lacked prior knowledge due to interrupted learning. Interviews showed that some AILs were forced to stay out of school because of immigrant or residence documentation challenges. Chinjo recounted that: "*I learnt only one month, came and sat at home looking for schools and my parents did not have proper papers*". Similarly, Brown et al. (2006) pointed out that some immigrant learners had little or no prior learning, little schooling due to interruption by war and political turmoil or struggles involved in leaving their countries of origin. When such learners enter school with little or no previous knowledge in the LoLT, they face the dual challenge of learning a new LoLT and learning MWPs from scratch (Setati, 2008). One interviewed teacher echoed that from his observation, South African schools admit immigrant learners; regardless of these learners'

previous level of schooling or skills, which could result in their teachers facing challenges. Brown et al. (2006) propounded that immigrant learners experienced a great challenge to acquire social communication skills and academic speaking, writing and numeracy skills; while endeavouring to keep up with native speaking peers who themselves were continuing to develop academic and language competence when solving problems. Classroom observations and interviews of participants both showed that most AILs tended to be uncommunicative when doing MWPs.

Some of the AILs had challenges when it came to discussing topics which were new to them. Noah stated that *"I can't talk English in class so I feel unwanted as I always ask myself questions as why can't I speak to others in class and hear what they are discussing during the lesson. It is difficult for me to fully participate in class".* Noah reiterated that "*I am afraid to speak and contribute in class because I am the only foreigner in my class and newcomer".* Noah's sense of being unable to participate and lacking in mathematics knowledge seem to contribute to his silence. Such learner silence could often be interpreted negatively by teachers as a reluctance or unwillingness to interact with others in class discussion (Endo, 2010). The teacher did not show awareness that Noah's silence in class might have been caused by lack of prior knowledge. Mr Erdan had this to say when asked about their interaction in class "*I have an immigrant in my class Noah**,** he is quiet and reluctant to contribute in class, I think he need more time to learn about what is happening around here as he is a newcomer and a foreigner. I could see that he is afraid of other learners, but it shall pass".* This finding was in line with Lave and Wenger's (1991), argument that legitimizing newcomer learners' increasing participation might open a way to accessing sources for understanding. In this case, Noah was not able to have any assistance from the teacher as his teacher misinterpreted his silence. African immigrant learners could feel abandoned without knowing that the teacher did not know how to cater for their pedagogical needs. This observation agrees with what I found during both lessons observed during which Noah was quiet. He did not participate or even work with others. He was seated alone at the back in the corner and did not seem to have confidence, appearing lonely and isolated from the class discussions. However, in other classes where there were two or more AILs, the situation was different. The learners were able to work together but unable to participate in class discussions because of perceived language barriers and the level at which MWPs were dealt with. Despite challenges in LoLT, one of the observed teachers was able to use group work effectively to assist AILs. Group work granted these learners an opportunity to communicate and share information more freely. Many learners were able to contribute during discussions because there was a safe medium: learners could challenge each

other and come up with solutions to their questions more readily. Moreover, the findings revealed that schools need to incorporate counsellors at schools to assist new learners so that they can be integrated well in the new education system.

4.10. Assessing learners' prior knowledge

In one of the classes observed the teacher, Mrs Ihoe had challenges involving AILs because they were seemingly not used to higher order questions. When interviewed as to why she was using higher order questions, Mrs Ihoe stated that: "*I had to vary my questions to different levels as to include all learners especially the African immigrant learners as they had difficulties with the LoLT in mathematics word problems*". The teacher stated that she used lower level questions to assess participating learners' preparation and comprehension in MWPs. This teacher used diagnostic questions to check the weakness and strength of learners so as to guide her on which topics or concepts needed to be revisited or taught; seeing that the syllabi of different countries are different. When interviewed, Mrs Ihoe explained that AILs lacked prior knowledge in many topics; especially MWPs related to topics such as algebra, trigonometry and financial mathematics, which made it difficult for them to move from one education system to another. These findings substantiated the classroom observations where some AILs had challenges with topics that were not taught in their previous countries. In some countries such as Somalia there could be low level or mere introduction to topics such as Financial Mathematics, whereas in SA it is treated in depth. Some teachers were forced to revisit topics taught in previous grades which seemed to be a disadvantage (wasting time) to local learners, since they had been taught in the previous Grades. Mrs Ihoe reiterated that she used higher order questions to encourage learners to think deeply and critically in mathematics problem solving, to embolden discussions and to inspire learners to search for more information on their own. The justification for using higher order questions by some teachers was to expose learners to critical thinking, as supported by Munzenmaier and Rubin (2013:7) who maintained that "instruction that stops too low on the Blooms taxonomy doesn't give learners that chance to think critically enough about what they are learning". According to Munzenmaier and Rubin (2013:7) "knowledge and comprehension levels may be used to determine whether learners can recall facts needed to make an informed decision". Some interviewed teachers faced challenges when they taught MWPs that demanded higher level thinking skills without realising that their AILs might have limited prior knowledge. The results from both observations and interviews revealed a gap between learners' previously taught mathematics content and the new content. Yet immigrant learners seem to interpret this teaching approach in a different way, as if teachers were not

teaching them well. This is echoed by Janice that: "*sometimes we cannot work on our own as it will be of higher level and difficult to us and don't understand the teacher*".

During classroom observations Mrs Ihoe used the following
Mathematics word problem: *Toto is four years older than John. John is five years less than twice Johan's age. How old are the three boys if their ages add up to 74?*

Solution

Let Johan's age $= x$
John's age$= 2x - 5$
Toto's age$= 2x - 5 + 4$ where $(2x - 5) is\ John's\ age$
Translate words into mathematical/algebraic expression that represent each child's age.

$$x + 2x - 5 + 2x - 5 + 4 = 74\ (sum\ of\ learners' ages)$$

$$5x - 10 + 4 = 74$$

$$\frac{5x}{5} = \frac{80}{5}$$

$$x = 16\ (Johan's age)$$

$$2x - 5 = 2(16) - 5 = 27\ (John's age)$$

$$2x - 5 + 4 = 2(16) - 5 + 31\ (\text{Toto}'s\ age)$$

$$\therefore Johan\ is\ 16\ years\ old, John\ is\ 27\ years\ old\ and\ \text{Toto}\ is\ 31\ years\ old.$$

This teacher had an excellent way of teaching MWPs however, she emphasised that LoLT was a major barrier for AILs: they could not understand the meanings of the specialized mathematics vocabulary *(John is five years less than twice Johan's age)*, language and they lacked prior knowledge in topics like algebra and equations. Echoing the above findings, Irujo (2007) stated that learners had problems with mathematized language. However, the classroom and walls of the school corridors were rich with mathematics word charts, and tables, translated in different languages of the diverse learners. The teacher when interviewed stated that she involved foreign teachers from another school in compiling her lessons, prepare the learning materials well in advance and even practised the delivery of the lesson. I observed in class that some AILs had challenges in forming algebraic expressions for the given word problems, because they were unfamiliar with the language used and the context of the MWPs. Some of the teachers demonstrated patience and engaged their learners freely in a conducive learning environment,

infusing learners' previous learning experiences and sometimes using culturally specific learning experiences. The learners' funds of prior knowledge provided some teachers with opportunities to merge them with the new content. Holtman et al. (2011) pointed out that learners find it challenging to manipulate word problems if they are expressed in an unfamiliar manner (non-real-life situation).

If learners are to understand mathematics concepts, the teacher need to tap into prior knowledge as supported by (Coady et al., 2013) as well as link new concepts with learners' previous knowledge. Relating mathematical content to the real world of learners, relating topics to their own lives and experiences, make it possible for learners to have a better understanding (Lavadenz, 2011). Learners' prior knowledge is totally embedded in their home language, and learners' success in mathematics is clearly dependent on learners' ability to connect the English words used in the classroom to their knowledge of their home languages in order to retrieve the already known mathematics concepts (Cummins et al., 2012). Merleau-Ponty (1962:177) maintained that: "children will not know something until it is named, the name is the essence of the thing and resides in it on the same footing as its colour and its form".

Some teachers stated that diversity in culture and language shared by AILs was an important advantage in mathematics lessons. Thomasian (2013:35) addressed this issue when stating that: "It is essential to assist learners understand the connections of mathematics content to their daily life experiences by intensifying classroom teaching strategies with hands-on mathematics activities". Teachers need to incorporate learners' real-life knowledge as a vehicle to enhance or facilitate learners' understanding or MWPs. The reason is that diverse learners bring in knowledge from their communities which could be of use to the entire class.

4.11. Transitioning between curricula

New AILs were observed to be uneasy in their new classrooms mainly because of the new curriculum under discussion. This observation agreed with the findings of Barton and Barton (2005) that new learners when arriving in New Zealand were confused and lacked the ability to access and follow the new curriculum in classes. It took AILs a considerable length of time to adapt to a new learning environment, teaching and learning styles. The transition took time because of the many challenges faced, a prominent one being a complete change in the LoLT. Learners with a low ability or learner background in mathematics would lag behind further by a new LoLT.

Adelman and Taylor (2015:32) explained the broader context of transitioning:

> *While it is evident that language is a fundamental concern, it is not the only concern, and in addressing that particular concern, care must be taken not to marginalize other factors related to poor transitions and adjustment in a new school, neighbourhood and country and ongoing obstacles to healthy social and emotional development.*

Some learners had difficulties understanding information that was not taught in their countries of origin. For example, Gumaka from DRC stated that "*I had problems to understand financial mathematics topic as it has a lot of words and it was a new topic to me in Grade 10".* The African immigrant learners' lived experiences as described in the extracts represented their subjective truth and embodied being-in-the-truth (Husserl, 1970) because of how they experienced learning in a new country. It was noted that each African immigrant learner's learning experiences were unique because each learner had a distinctively different learning background and own understanding or perception of learning in a new country with a new LoLT. Some of the AILs relied upon their prior mathematics learning experiences because of frames of reference in their perceptions of learning MWPs in LoLT. Curriculum coverage of different countries was one of the challenges for AILs. Ema stated that she repeated some of the topics that she had already done in her country. Some AILs had problems in the repetition of content as well as in being excluded from other topics of which they had no prior knowledge.

Classroom observations showed that AILs with low LoLT proficiency seemed unable to cope with the new LiEP that the MWPs demand comprehension and reading skills in the LoLT (DoE, 2003). African immigrant learners were observed to struggle with reading MWPs as well as with interpreting these questions due to the use of CALP. These findings agreed with learners' interview comments that the LoLT used was difficult for them. Interviewed teachers affirmed the importance of having limited proficiency in LoLT.

Some immigrant learners suffered due to long periods of interruption in their schooling. Mubarak said "*I cannot understand English as I used Bari [a Sudanese language] at school in all my subjects and I have stayed out of school for three years*". Most immigrant learners had compounded problems with the LoLT, new curriculum, limited previous learning experiences and not attending school for a long time. Many teachers asserted that the new curriculum for AILs should not focus so much on proper grammar usage as on real-world situations that could

allow learners to cope. Their views were supported by DoE (2014) that learners need language as a resource for learning to assist them to cope with the curriculum demand.

Although they complained of the English language, some immigrant learners commented that mathematics as taught in SA was easier because teaching incorporated continuous assessment. Chinjo stated that: "*Here you can research and get marks that counts to your report as compared to my country you only have marks for end of year examinations and no continuous assessment marks"*. The South African way of assessment motivated learners to work harder in order to pass promoting smooth transitioning to the new education system.

4.12. Conclusion

This chapter dealt with the analysis of narrative data that pertains to the impact of LoLT on the teaching and learning of participating learners, mathematics language, prior knowledge as well as the curricular transition. In chapter five, there will be an extended discussion of the findings of the study. Certain issues emerged such as isolation and exclusion of AILs, the use of technological resources (through limited), and use of CS, teacher experiences in teaching AILs. I discussed teacher-learner, learner-learner interactions, stigmatisation, marginalisation and invisibility of AILs in the learning and teaching of MWPs.

CHAPTER 5
PRESENTATION OF DATA, ANALYSIS AND DISCUSSION OF RESEARCH FINDINGS FROM TEACHERS

5.1. Introduction

In chapter four, I discussed the analysis of the impact of LoLT on the teaching and learning of participating learners, mathematics language, MWPs, prior knowledge as well as the curricular transition. In this chapter the findings of the study are discussed further. A more detailed critical discussion of the findings is presented, focusing on the emerging themes in the preceding chapter, namely caring, isolation, stigmatisation, marginalisation, invisibility, interactions between participants as well as teacher experiences in teaching of immigrant learners.

5.2. Caring and sense of belonging

This study revealed that different teachers had different ways of teaching new learners in their mathematics classrooms. Some were concerned with caring for such learners while others appeared apathetic or indifferent. One learner, Gurazzy from school B stated that:

> *I found comfort at school in mathematics classes as teachers included us in all learning activities. Sometimes the teacher could take photos of us with others or videos when having mathematics discussions and presentations. I liked it because it reminds me about my first days learning mathematics in English. I felt a member of the class and recognized by my new teacher and classmates as time progressed.*

These learners felt valued as individuals and appreciated in the same way as local learners. They had a sense of belonging which helped them to be confident and so able to tackle MWPs tasks, without being afraid of making mistakes. Observations in some classes showed that participating learners had equal access to learning opportunities; regardless of gender, ability, ethnicity or nationality. Their classroom environment was generally conducive and accommodating for newcomers, in particular, for AILs. These learners felt at home and cared for as part of the learning community. This observation is in line with the sentiments of the teacher, Mrs Ihoe from school B: *"Our school provides a welcoming environment to new immigrant learners through engaging them in mathematics clubs and games that demands use of mathematics word problems"*.

When asked about their competence in teaching AILs, teachers expressed a number of different opinions. One teacher, Mr Roca from school B, stated that: "*At our school, we have Ubuntu*

(humanness) among teachers and learners, where teachers, care, love, facilitate, guide and assist each other especially those in need (newcomers)". Some teachers confirmed that genuine care was taken to enable AILs to adapt to the new learning environment. African immigrant learners were allowed to air their views or challenges in the learning and teaching process. Mrs Ihoe affirmed that everyone was involved in issues that concerned the school where parents were invited to school to discuss issues concerning their children. In support of these views a participating learner, Janice from school B remarked that: "*I haven't had that experience in my life where a group of strangers care so much. It was a human thing, very supporting. I felt very connected with the teacher and some learners in my class".* These results showed a sense of care and belonging among learners and the teacher. In these classrooms a nurturing and caring environment was created by both teachers and local learners. As Suarez Orozco et al. (2009) postulated, schools should be places where learners can feel that they learn freely, happily and comfortably in all spheres of learning and teaching.

One teacher, Mr Erdan from school A commented that "*they did not have a supportive environment in their school that could assist African immigrant learners to transcend generally well in school environment and in mathematics classes in particular".* Mr. Roca stated that, while the school tried to care for all learners, in reality some teachers and local learners did not treat AILs in the same way as local South African learners. African immigrant learners face adjustment challenges with regard to a new LoLT, unfamiliar rules and norms, morals, and the way to relate to both teachers and learners in their day-to-day life. These findings are corroborated by the research findings of Suarez-Orozco et al. (2009) with English language learners in USA, where immigrant learners were not taken care of in their classes.

In their study Koeller and Jacobs (2015) found that teachers did not enjoy good relations with immigrant learners, which prevented them from addressing these learners' educational needs and assisting their transitioning to new educational system. Choi et al. (2011) noted that when teachers fail to show care and accept new learners in their teaching processes, new learners often lack confidence, trust and motivation to do their school work. In diverse classes learners should not laugh at each other but promote togetherness, and a culture of collaboration. Some teachers observed in this study were unable to assist or work with AILs.

One of the interviewed teachers, Ms Mdamanest from school A, affirmed that:

> *Immigrant learners nag me a lot and I told them not to nag me again because I am not learning for them and that they should study and work independently. I am there to facilitate. Even working in groups is not about choosing your own group. No learner should be in a group of their choice (in their comfort zones).*

Such teachers' attitude could affect African immigrant learners' attitude towards learning MWPs. Although these learners had learnt and tried to use English better than on their first days of arrival, they felt excluded from their school and mathematics classrooms. Some teachers reported that there were many learners in their classes and they were unable to take care of all of these learners because they needed more time to understand the LoLT. When AILs were not involved or did not take part in group discussions there was little sense of association with both local learners and the teacher. One participating learner, Abdullah from school A stated that: *"Local learners use their language; therefore, what do you expect me to do. It means that they are chasing me away from their groups and I feel not wanted".* Such findings reveal that AILs need to be accepted by local South African learners and teachers through the use of common LoLT. Brown et al. (2006:158) noted that "a sense of connectedness, of being part of and accepted by other learners provides a context within which learners are willing to take risks with language of learning and teaching".

One teacher, Mr Maomanii from school B argued that South African schools "*need to cultivate a different culture in their learners, they should teach South African teachers and learners to embrace other learners from different nations who cannot speak local languages or the LoLT or even share their culture".* New AILs need teachers and learners to help them to adjust to the new culture of the mathematics classroom, by fostering a sense of care and belonging (Mckinery & Norton, 2008). School B had a variety of programmes aligned to AILs, including after-school programmes led by teacher aids, parental involvement, reading and use of native teaching and learning resources, and workshops to involve all stakeholders. One of the interviewed learners, Mubarak from school A stated that: "*I do not think I belong here, these people do not think I belong here. These people they do not like us, the teacher does not like us and we are seen as foreigners or invaders (unwanted, poor and dull learners)".* Another learner, Lube from school A claimed that: *"After having a class discussion, I had problems in understanding the content under discussion, I went to the teacher for assistance, unfortunately, the teacher seemed not to care or bother about my challenges and he did not provide any help".* The findings showed that AILs were faced with a challenge of segregation by some of their teachers. Some learners sensed that they were outsiders in the classroom because they were not given much attention by the teacher.

Vandeyar and Vandeyar (2012:162) found that "attempts were also made to learn English, not only to find a sense of belonging but more importantly to enhance understanding and learning, since both teachers and students only spoke English during lessons". Wright (2010) advised that although teachers should understand or know their learners' cultural background and ethnicity, they should avoid stereotyping and generalising since each learner is unique. Wenger (2000) likened the school to an onion of belonging; with new arrivals typically secluded on the outer rings, local learners deeper towards the centre and the most affluent at the sweet centre. This study showed how important it is for newcomers to be made a part of the larger school community. Among themselves, some teachers worked on cultivating a caring and respectful learning environment in which all learners feel comfortable, motivated, and confident in what they were doing.

5.3. Isolation of AILs

From classroom observations it appeared that some learners were withdrawn and found it difficult to concentrate; they seemed to have impaired concentration; especially when dealing with MWPs. Some teachers did not appear to care about the well-being of the AILs. Mr Erdan from school A, observed: *"I do not know what the problem with these learners is, they are passive and do not show any interest in learning of mathematics. It seems as if they are lost and do not know why they are coming to school. I am not a psychologist who should counsel them".* Some teachers did not know their responsibilities as teachers to provide equal education to all learners inside South African borders irrespective of nationality and culture as (Klotz, 2013:193) pointed out that "the South African constitution (1996) stated that rights should apply to all people who live in it". Education for all was not practised; on the contrary, some of the teachers were challenged by the social and educational demands of AILs in the learning of MWPs. This finding was congruent with the view of Adelman and Taylor (2015:23) who indicated that: "among the most obvious concerns for schools are addressing groups of students with limited English language and cultural differences both of which may generate behaviours among peers and staff that are associated with prejudice and discrimination".

Most African immigrant learners were seen to be isolated. One interviewed learner, Lube from school A, pointed out that "*Even if I had friends who spoke my home language, there was no appropriate interaction or connection with local South African learners as they were excluding us from their groups and I felt so lonely*". African immigrant learners were seen to avoid working with local South African learners. They were afraid and shy to work or present in front

of the class because they felt inferior to local learners. One teacher, Ms Mdamanest, had this to say: "*African immigrant learners are not sociable as they distance themselves from local learners".* These findings support the research of Anderson et al. (2015:25) who claimed that "non-English speaking immigrant learners may compare themselves to English-speaking peers and could avoid class discussions that involve social interactions".

Some AILs felt that teachers were the root cause of their problems. They claimed that teachers taught at a fast pace and were reluctant to answer their questions politely and were rude and angry when asked questions. One of the interviewed learners, Mubarak from school A stated that:

> *I always do my mathematics at the mosque where we are taught nicely and our teacher at the mosque moves around explaining to everyone in our language. It is not like here at school where the teacher tells us to do the problems alone and she sits on her chair. The two mathematics are different and I am confused at school because this teacher is rude and does not explain and she always scold us saying 'magweja', 'Ikwerekwere' I hate this Mistress a lot because she hate me. This teacher does not care about us foreigners because she does not assist us foreigners but locals only.*

These findings agree with those of Sookrah et al. (2005) that show some teachers spoke faster in English and some were uncooperative in terms of making sure that learners understood the concepts under discussion. Such teachers' unprofessional behaviour in not treating learners equally and not assisting AILs in the learning and teaching of MWPs, led to these learners feeling isolated.

African immigrant learners in this study felt ashamed when they failed MWPs tasks, so increasing their isolation. They were shy to participate in class activities such as presenting a project to the class as a whole. Since they had little previous knowledge of the MWPs concepts, these learners were always lagging behind local learners. African immigrant learners felt so left out as to regret coming to school. An interviewed learner, Abdullah, reported that *"I hate coming to school as I am always behind local learners they have done some of the information. I feel so stupid*". Another learner, Simbe asserted that: *"I just sit at the back of the classroom so that other learners and the teacher cannot notice my presence, I cannot communicate in English. What should I do to communicate with others, I think of staying at home than coming to school".* This experience supported the observation of Adelman and Taylor (2015:32) "It

often is suggested that lack of proficiency in English is the primary cause for the high dropout rates among language-minority students".

These findings showed that AILs experienced association challenges which affected them psychologically, so that they became ashamed of themselves and were not able to be confident in their learning of MWPs. Some AILs stated that they were afraid of being mocked by local learners. Yet other AILs were resilient as well as interested in class discussion where they wanted to prove their intelligence to the peers in their classes. One of the interviewed participating learners, Janice from school B, asserted that: *"I am not shy I persevere and this will show my capability, if not good I learn from others, I like competition so I would like to show them that I also know my mathematics word problems and that I am intelligent".*

Some of the interviewed learners reported that they were not comfortable learning with local learners because of these learners' attitudes towards them. Lube stated that

> *During my first days here in South Africa, I felt isolated by South African learners, no one wanted to sit next to me or even talk to me. They were teasing me, making all the funnies with my accent, dressing, hair style, when the teacher asked for my introduction. Some of them asked me if I have ever used a computer and know what a phone is. I tried to explain to them but they laughed at me as my English was broken (They called me names like Dom, Baro (stupid) or fool in their language.*

The findings revealed immigrant learners' frustration with their South African classmates' negative comments, limited interaction with them in learning MWPs and rejection because of their accents, skin colour and dress. One of the Somalian learners stated that they were sometimes ridiculed by local learners because of their Muslim dress and accent. Some local South African learners distanced themselves from AILs when working in pairs or groups. One participating learner, Mubarak from school A, stated that "*There is always someone in the classroom who will treat us differently".* Most of the AILs felt that teachers and local South African learners did not like to associate with them. One of the learners, Danest from school A, reported that: "*My own thinking is that these people do not want to associate with me because I am a foreigner and have come to their school to take their education*".

Some of the participating learners had problems with their teachers in terms of assistance; there was no or little teacher support for AILs. Another learner, Simbe stated that: "*Our teachers and the South African learners treated us with disrespect, they bullied us. They did not want to see*

us happy and always talk behind our back, our teachers did not treat us as human beings like SA learners, and they scold us and always say rude words". These findings are in line with those of Traore (2006) who stated that in the USA newcomer immigrant students were not recognised by their American peers because of their accents and race differences. Sofo et al. (2013) contended that stereotyping learners could result in them feeling excluded from the learning and teaching process. De Jong and Harper (2005) added the recommendation that teachers should avoid stereotyping learners and should recognise and appreciate their presence. It was found that some AILs were excluded because of their clothing fashion, dress code, accent, and the mismatch of cultural experiences.

One participating learner, Abdullah from school A, reported that:

> *We have been victims of insults from South African teachers and learners. I am very good in mathematics and I am the best in class in other topics except mathematics word problems. Some SA learners are jealous and they hate me as one said to me. How do you become so good in mathematics if you are not good in English? Go back to your country you want to act as if you are clever. Do you think you belong here, you are a foreigner you cannot be good in mathematics.*

Some AILs were dropping out of school because of their inability to cope with the new education system. African immigrant learners in school B were able to explain in front of the class. These AILs were confident because they sat in front of the class and presented during class presentation. Janice stated that "*We are now confident as compared to last year when we started here, my English is better and I am able to understand the language of maths*". Mr Roca from school B claimed that *"Janice now sits in front and is not shy and always fluent and confident now than before, she is powerful and talk as well as explain her mathematics thinking or understanding"*. Some AILs were vocal and sociable as well as confident with their mathematics. Adelman and Taylor (2015) pointed out that in a positive school climate and with proper and on-going support for transition, new learners could engage and work positively with others.

During classroom observations some participating learners from school A did not talk even when asked by the teacher to respond to questions; they kept quiet which could mean that they were shy and frustrated or embarrassed because of their cultural beliefs or previous learning experiences. African immigrant learners felt frustrated when they did not understand some of the parts of the lessons taught as MWPs. This tension was highlighted when they were familiar

with concepts in their home language but experienced difficulty expressing their thoughts in English. African immigrants felt isolated from local learners because they could not understand what local learners said: such communication problems result in embarrassment.

One teacher, Mr Erdan from school A, commented: *"I do not want to see learners from one country (African immigrant learners) seated together they talk their language and I do not know what they will be saying, it makes me frustrated and annoyed"*. He did not consider the richness of ideas or abilities or knowledge immigrant learners possess or the benefit they could have from discussions amongst themselves. Barwell (2008) recommended that learners should be encouraged to use their home languages in the learning process, bringing into discussions their cultural knowledge and mathematical experiences. Some teachers' attitudes towards immigrant learners were negative and resulted in learners feeling resentment about the learning of MWPs as well as about mathematics as a subject. In my observations, AILs were separated into group discussions and even the seating arrangements isolated immigrants. In one class there were five immigrant learners, two from Somalia and three from the DRC. They were seated at different positions; one at each back corner, and others in different rows and columns. These learners were withdrawn, passive and reluctant to participate in class. They did not take part in whole class activities and even if the teacher asked questions these learners remained silent. When interviewed after the classroom observation, Danest from school A stated that: *"I was surprised that Mrs Mwesto wanted answers from us because she does not even want us to present or give answers in class, she hate foreigners may be she changed today because you are around, then she acts as if she cares".* This teacher seemed frustrated and appeared uneasy when she saw that I noticed that she was not interacting with AILs.

Immigrant learners in school A showed associative deficiency when learning MWPs. According to Kirova (2001), feelings of isolation could drive learners to search for refuge with learners who share a similar background to their own. By contrast, some of the AILs in school B were able to associate with local learners and their mathematics teachers. One learner, Rana from school B reported that

> *Our teacher put us in one group of foreigners from the same country. We were able to use our home language, French to manipulate the word problems. It assisted me because I had many co-nationals who were explaining to me so that I could understand the concepts in the word problems. Another learner in our group was good in mathematics and was able to explain to us than the teacher,*

> *he explained slowly and patiently for us to understand better. He was better than the three of us. I was so comfortable to be grouped with learners from my country.*

These results revealed that group work and CS assisted learners to cooperate and share information. Orey (2002:45) stated that: "learning is a cultural process by which individuals from the same cultural group can construct their mathematical knowledge in a cooperative way". However, some learners interviewed were bored with learning in these new environments as Danest from school A explained:

> *I think of running away from the class because it is English every time and I do not understand it, I cannot even speak it as it is difficult and new to me. My parents do not help me even with homework and I am left alone. It is better to abscond the lesson or to drop out of school because it is too much for me. I used to like learning in my country but, here it is more than a jail or punishment if I go to school. I do not feel free I am like a prisoner. Local learners and the teacher isolate me as if I am stinking or I am mad or crazy.*

This statement is in line with the findings of Suarez-Orozco's et al. (2008) that immigrant learners had little opportunity to interact with peers who were not from their country of origin; resulting in isolation from the learning process. Van Manen (1990) found immigrant learners frequently lacked a sense of selfhood, felt segregated and unwelcomed by the school environment because they lacked communication skills. They felt inferior in front of others, which could have resulted in high dropout and absenteeism rates.

The results of the study showed that some of the AILs felt that they were different and disconnected from local learners; as one participating learner, Muthuli from school A stated that: "*I was the only foreigner in my class, feeling very different and very isolated. I was different from South Africans*". Some learners in this present study were seen to be withdrawn, aggressive, passive, not concentrating properly, hyperactive (talkative) and moving around in class without doing schoolwork. One of the interviewed teacher, Ms Muchova from school A averred: "*These learners are too mobile and make noise as a mechanism to cover-up their lack of communication or unable to cope with the learning situations. There are too many learners (58) in my classroom, I cannot offer immigrant learners additional support and special preferences*". Due to the huge number of learners in classes it becomes an added burden to teachers to pay extra attention to these learners. However, some respondents reported that they were always behind local learners in most of the mathematics content that they learned. Some learners seemed ashamed when they failed a test or were unable to complete the task because

of the language barrier; in particular the mathematics language, and they then isolated themselves from the classroom learning and teaching process.

5.4. Use of technological resources

The use of technology was another difficult experience for AILs in the learning of MWPs. When interviewed, Gumaka stated that: "*Having grown in the countryside of DRC in a remote rural area, I had never had a computer, cell phone or learned using a projector or whiteboard".*

This account was in line with Janice's concerns that:

> *Using computers was difficult for me and it resulted in me getting lower grades as compared to my previous school in my country of origin. I did not know how to use the computer. No one assisted me or even explained to me how the programs or activities on the computer were done, even the teacher did not assist me, I had to ask other learners for assistance. It was a difficult experience to me as I felt excluded or left out or lonely in the new situation. But, through much practice I am able to use the computers and I have gained a lot.*

The use of technology in teaching affected AILs because they were unable to listen, read, understand, interpret, identify, and record important words simultaneously while processing incoming information. As noted by Van Manen (1997) the learning environment or lived space was novel for AILs at schools with resources richer than their previous school environment. African immigrant learners felt that they needed resources to participate fully and actively in learning MWPs. One of the interviewed learners Ababa, stated that

> *Our new classes are so nice with a lot of computers and internet, in our country we did not use computers and even know them, we were learning in muddy classes without electricity. Using computers was an exciting experience to me, I was able to learn new things and working alone, it was difficult for me at the beginning because it was my first time to use a computer.*

By contrast, in school B, AILs had an opportunity to be assisted in using computers by the teacher and other learners because there were some co-national learners they could associate with. They were able to share information and work together. This school had enough resources, although there were not enough laboratory assistants to provide individual assistance seeing that the class sizes ranged from 40 to 58. Some of the assistant teachers were themselves African immigrants who were able to understand the foreign learners better than the local teachers. There were no Information and Communication Technology (ICT) assistants to supervise and

facilitate the use of computers in the learning and teaching of mathematics. In these circumstances it was not easy for immigrant learners who had not used or who had problems in the use of computers to manipulate MWPs.

It was observed that most of the AILs were uneasy because it was the first time of seeing and using a computer. These learners perceived themselves to be different and inferior when they saw local learners working independently with computers. This observation was supported by Noah from school B who stated, "*I felt out of place and inferior as I had never seen or used a computer in my country*". These findings were in contrast with what one interviewed teacher, Mr Maomanii from school B averred: "*The use of computers was an exciting moment to African immigrant learners as they were attentive when I was teaching but, were unable to use the computers in solving mathematics word problems*". Classroom observations showed that AILs did experience problems in using computers and needed teacher assistance; which in turn overburdened the teachers since they had a large number of learners in each of their classes. Despite the large number of learners in mathematics classrooms, some of the teachers observed were able to introduce learners successfully to the use of computers in solving MWPs.

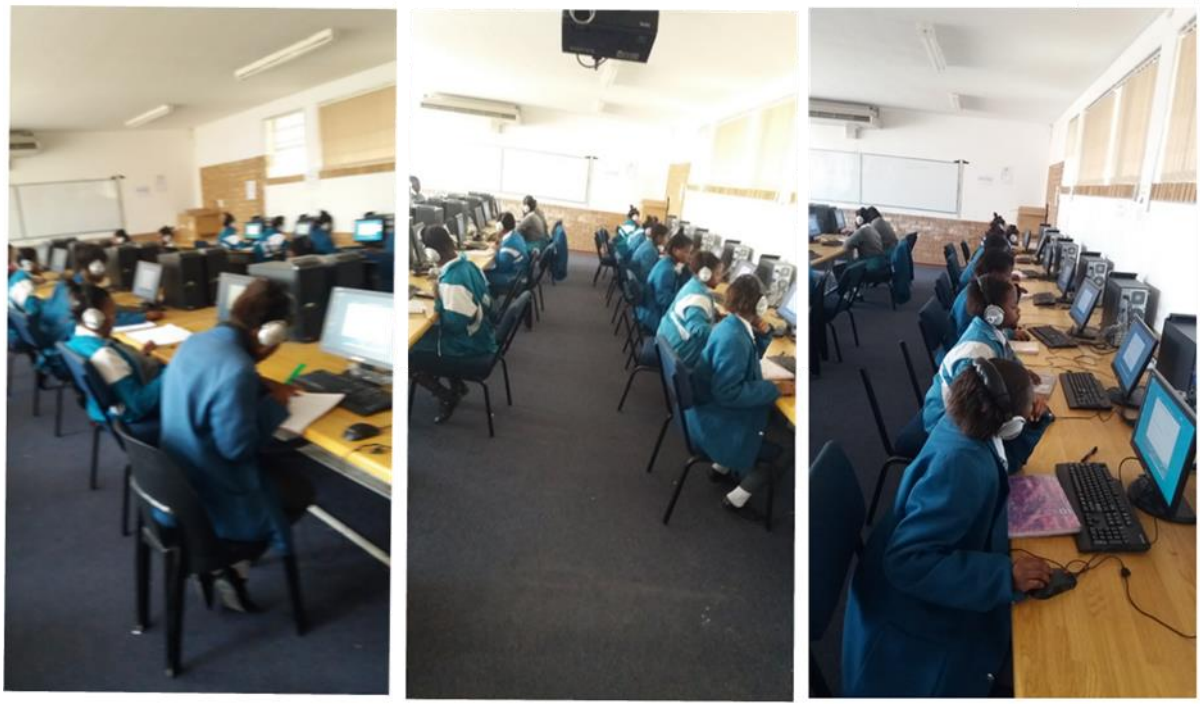

Figure 5.1 Views of learners using computers in a mathematics classroom

In contrast to the resources AILs had had in their countries of origin, they were exposed to a variety of technological resources in their new country, such as interactive white boards, internet facilities and well-equipped laboratories. They had access to textbooks. The classroom

environment provided a platform to follow the constructivist approach prescribed in the National Curriculum Statement. Conroy (2003) argued that resources for teaching and learning benefit from their effective use within or through the school, its community and environment. The use of computers was in line with the DoE (2011) declaration that the SA educational system aims to produce learners who will be able to use technology effectively, efficiently, creatively and critically in the learning and teaching process.

When using computers, laptops and personal phones in learning MWPs, there was a perceived need to change language or to have a translation application to promote all learners' better understanding. Immigrant learners added that they were excited and motivated to learn mathematics despite the fact that they had challenges in understanding MWPs expressed in LoLT (English). Although there was an abundance of resources, some AILs were not able to work independently because they faced challenges in reading and comprehending MWPs. The use of 'flipped' classrooms and the use of technology in the classroom, allowed for more time in the classroom for interaction between teachers and learners; providing teachers with opportunities to guide learners through technology. Use of technological resources in learning and teaching provided a greater opportunity for learners to enhance understanding. African immigrant learners were able to explore their lived experiences in the learning of MWPs with the use of technological resources which were available in the current country.

We can also discuss how learners experienced the learning resources at their new school as compared to their previous schools. Most learners stated that their new schools had enough resources. Each learner had his or her mathematics textbooks and was able to use computers in the learning of MWPs and mathematics in general. Although the learners had to share computers, they were excited and wanted to do better, despite their struggle with language and computer skills. This shows that the new learning environment was relatively strong in terms of resources compared with the previous environment of AILs (Van Manen, 1997; Makoe, 2008; Jhagroo, 2011). When interviewed one learner, Rana had this to say:

> *This is my first time to have my own textbooks and use a computer. There is nothing like using computers in my previous country. It is only chalk and talk. We used to share one textbook among five learners. Therefore, I did not have a chance to take even one textbook home and practice. I am so blessed to learn at such school.*

The use of visuals by some teachers to scaffold mathematics concepts helped learners to understand the mathematics content. Mr Maomanii stated that: "*I used iPads, desktops to allow African immigrant learners the chance to interact with mathematical content in a visual form*". Technology helped learners to translate mathematical terms quickly. A misunderstanding between teachers and AILs arose from the use of mathematics dictionaries when a teacher, Mrs Muchova from school A claimed that: "*You have to find or search information or meaning of mathematical terms by yourself*". Some learners interpreted the teachers' response as rude and uncaring, without appreciating that the teacher was actually promoting their independence and confidence in the learning of MWPs.

It was also observed that the use of visuals, pictures as well as learners' prior knowledge promoted better understanding of MWPs. Particular learners responded differently to particular teaching and learning strategies. For example, during an interview Mr Maomanii stated that: "*After using technology, visuals and diagrams on the whiteboard to illustrate mathematical word problem tasks, it assisted learners to understand better*".

In summary, learners had an opportunity to be exposed to different ways of knowing and learning through multiple learning styles when using technology in mathematics. Participating learners were able to experience the use of learning resources such as internet, textbooks, computers, and language books.

5.5. Strategies to assist teachers and African immigrant learners

In both schools A and B, it was found that AILs were not provided with programmes to assist them in understanding MWPs. The DoE seemed not to assist teachers to develop strategies to support AILs in learning mathematics. This finding was supported by Botes and Mji (2010:17) who noted that, "In the South African context linguistic diversity is a complex issue. It has increasingly become the task and responsibility of educators to develop strategies in an attempt to facilitate quality education for their learners". Most teachers seemed to experience challenges in trying to teach or assist AILs seeing that their home languages and their previous LoLT were different from those of the local learners. The burden of catering for AILs was felt by teachers and schools while little support was provided by the DoE. Melville, Hardly and Bartley (2011) argued that, without sustained help, it becomes difficult for teachers to overcome the day-to-day challenges they face when teaching diverse learners. Lavadenz (2011) suggested that learners with no or little command of English need to be provided with English language development so that they are at par with their native English learners in content area instruction.

5.6. Use of code switching

Some teachers interviewed used CS in their classes. Some were observed in class using CS and explained that CS assisted them to explain the concepts clearly to learners. Some teachers used CS to translate terms so as to enable learners to link their prior knowledge with the current one. This motivated learners to do more word problems and it increased class interaction. Mr Roca from school B reported that: "*I asked co-national who finished here at our school to assist in using code switching and explaining the mathematics terms in the immigrant learners' home language. Translation assisted me a lot and I could see the happy or smiles on their faces (learners)".* Most teachers were not able to speak the African immigrant learners' home language and so could not use CS to assist these learners although the DoE policy allows and promotes the use of learners' home language as a learning resource (DoE, 2011). Lavadenz (2011:32) reiterated that "the concept of primary language support is essential to providing an additive versus subtractive approach to acquiring a second language".

One teacher stated that he tried to link everyday concepts with the mathematics concepts using CS but had problems using African immigrant learners' home languages. Similarly, Barwell (2011) averred that teachers and learners at high school use CS in mathematics classes to help learners understand. One interviewed teacher, Mr Watso from school A, asked:

> *How can I use code switching to such a diverse class? I do not speak all these languages. This is a very big problem for me. The DoE, school do not support me. Even if I use code switching it is waste of time and energy as only South African learners speak my language IsiXhosa because I have learners from Somalia, Sudan, DRC and Madagascar.*

Ron (1999:142) suggested that teachers should "understand learners and the linguistic characteristics of classroom language and also must have mastery of techniques that will assist learners in connecting everyday language with the mathematics language". Cummins (1986) and Janzen (2008) supported the strategy of allowing learners to use their home languages and culture because concepts could be easily transferred from learners' home language to the LoLT. Teachers should be consistent and clear when using mathematics vocabulary and should inspire learners to use mathematics language so as to promote mathematical thinking. One of the AILs, Ema from school A, interviewed stated that: "*I do not have anyone to work with, I am left alone, I feel lonely, bored and want to drop schooling the teacher uses his home language in teaching us*". This statement shows that some immigrant learners had no-one to associate with when it

came to doing group work. Concerning classes at an English-Afrikaans medium school, one learner, Danest from school A stated that: "*When our teacher explain mathematics word problems in another language (Afrikaans) that we do not understand I become confused because I do not know Afrikaans*". Some participating learners reported that they felt frustrated, angry, incompetent, disempowered and in need of switching off. One teacher, Mr Maomanii from school B asserted that: "*I give African immigrant learners simple content because if I give them up to standard they won't make it. They can communicate socially and I try to make them communicate in English so that they could acquire the academic language bit by bit*". Brown et al. (2006:158) concurred: "learners who are confident in communicating in social language are more likely to participate in academic interactions while those lacking confidence in social language are likely to be reluctant to do so".

However, some teachers argued that AILs should be given academic language because that is what they have to acquire. Barwell (2008:153) concurred that: "At risk learners require instruction that is cognitively challenging and demanding of analysis and critical thinking, not just drills and repetition". This implied that teachers should set challenging standards for their learners and then prepare lessons that help learners to achieve these standards so that they acquire all concepts under discussion regardless of their competence in the LoLT. An interviewed learner, Simbe from school A, recounted that: "*It was difficult for me to settle in a mathematics class as I heard new different languages spoken in my class. I could not understand the language used by both the teacher and the local learners, all these languages were totally new to me*".

The large number of learners in a class compromised on-time delivery of the curriculum because teachers found it difficult to assist learners individually. Teachers seemed unable to use group work where learners were encouraged to use CS to promote their understanding of MWPs. These sentiments were echoed by Mrs Ihoe from school B stating:

> *I cannot reach to the needs of all learners as they are many, diverse which is a challenge for translation or group them as they cannot communicate in English. So I just teach them survival language skills and a little of academic vocabulary gradually. I always try to determine the prior knowledge learners bring to classes and plan the lesson from that point.*

Some teachers tried to assist AILs by noting what learners had learnt before in their country of origin, that is, their lived or learning experiences (Van Manen, 2007). In contrast, Mrs Muchova from school A noted that

> *In my class there are many learners and it's a big challenge for me to know what they learnt from their former schools especially the African immigrant learners, how do I know that they have covered such topics and that is linked to the new curriculum as I do not know the African immigrant learners' previous curricula.*

Teachers may have to encourage AILs to use their home languages in group discussions so as to promote understanding. Deussen et al. (2008:6) concurred that "teachers should use bilingual instruction when feasible, which leads to better reading and content area outcomes". However, since local teachers could not know what these learners would actually be talking about, there was naturally a fear that they could be discussing issues other than the work at hand. As stated by Janzen (2008:1017): "teachers should take advantages of immigrant learners' home language and experience rather than disregarding them". The use of CS could assist learners; only if they can communicate in all languages. African immigrant learners could benefit from CS into a local language provided they are able to understand both the LoLT and local languages.

When asked during interviews why he used code switching, Mr Erdan from school A stated that "*Using code switching just happens naturally and I want to assist learners to understand the mathematics concepts better by using their home language by explaining big words in these mathematical word problems*". However, another teacher, Mrs Mwesto from school A, stated that:

> *I cannot speak or communicate in African immigrant learners' languages therefore, it is a challenge for me as I cannot be able to simplify my explanation of mathematics concepts in their home languages to make them understand the mathematics word problems better. Moreover, I cannot use code switching in their languages as I do to South African learners.*

This teacher reported that CS was a teaching method recommended by the DoE to use, because code switching assists learners to understand concepts first expressed in the LoLT. Jegede (2012) and Halai and Clarkson (2016) found that the use of CS assisted learners to understand mathematics concepts. In this study, some interviewed teachers believed that the use of learners' home languages assisted learners to get the meanings of the topic under discussion. A

study conducted by Vandeyar and Vandeyar (2012) on Indian learners in SA found that teachers were treating immigrant learners the same as black South African learners, regardless of their competencies in LoLT or South African local languages. Similarly, Suarez-Orozco et al. (2009) conducted a study in the USA with black African learners who were found to be treated the same as native-English speakers. Janzen (2008:1025) advised that teachers should be "careful observers of learners and identify the needs and background of these learners without relying on stereotypes".

When interviewed, Mrs Mwesto was asked why she used CS although the class comprised locals and AILs who could not speak the local learners' home language, Afrikaans she responded that: "*there is nothing that I can do because I cannot speak the immigrant learners' home languages. If I could speak their languages, I could also explain in their home languages, then it is bad luck for these learners*". This exemplified a pattern that some teachers were using CS to help learners to understand MWPs; while implicitly excluding AILs who were unable to communicate in local languages and LoLT. The DoE was not assisting in this regard. One AILs, Mubarak from school A reported that

> *Our teacher (Mrs Mwesto) always do it and she uses her language a lot without taking care of us, she is rude, and sometimes she threatens us to fail if we report her to the principal. We are afraid, she does not teach us because she uses Afrikaans every time but, we are in an English class which is supposed to use English only in the learning of mathematics.*

Learners who are threatened in such a way in a mathematics class might well become nervous and uneasy in the learning of mathematics. Cummins et al. (2012:31) argued that "the fact that instruction was conducted in English and the teacher did not know Urdu or the other home language of learners in her multilingual classroom was not an impediment to the implementation of bilingual instructional strategies". In classes where teachers could not use CS or where the teacher does not speak the participant learners' home languages, the school could offer newcomer programmes for recent immigrants to help them learn Basic English, so that they could become conversant with the South African LoLT.

South Africa currently lacks programmes to help AILs acquire the LoLT. The AILs are disadvantaged because of limited bilingual opportunities that can offer their home languages and the LoLT. South African learners have bilingual dictionaries available, such as IsiXhosa to English or Afrikaans to English but immigrants must rely upon on-line translation facilities

such as Google Translate. Cummins (1984:57) proposed that schools should have "immersion programmes which, when properly understood and implemented, appear to represent an appropriate form of enrichment of bilingual education for all students, whether from a majority or minority language background, learners requiring a special education programme or not".

An interviewed teacher, Mr Watso from school A stated that: "*I only teach as what my previous teachers did through code switching*". Teachers may model their own teachers upon what was done to them by their own teachers, as expressed by Constandi (2010:88) that "we teach who we are". Based on learners' descriptions of their experiences, it is fair to say that teachers' past never completely disappears but lives on within their lived spaces and is spread over the long expanse of their teaching lives. Teachers play a crucial role in the learning experiences of newcomer immigrant learners in the learning and teaching of MWPs (APA, 2012).

5.7. The use of co-national assistant teachers

After 15 months of conducting this research, a programme was implemented in the schools involved to use assistant teachers who shared in common language with AILs. These teachers assisted in teaching AILs mathematics through CS after school. These assistant teachers were drawn from the DRC, Somalia, and Sudan because many learners came from these countries. It was found that learners were able to discuss matters with each other and were free to communicate knowing that there were teachers from their home countries to assist them through the use of their home languages (Cummins, 2000). One of the South African teachers, Mr. Roca from school B, interviewed had this to say:

> *Our school recruited culturally and linguistically diverse learner helpers, tutors and parents (African immigrants) to assist in our classrooms. These extended members of the classroom community communicated high academic expectations to immigrant learners, potentially resulting in prejudice reduction for everyone involved in the class.*

These sentiments provided an insight into the importance of languages and how immigrant learners might develop understanding under the guidance of a teacher who is able to use the LoLT from their home countries (Nkambule, Setati & Duma, 2013).

Having positive academic role models from other countries at school to relate to and identify with, engaged learners, and maintained their motivation to learn better in their new learning

environment. Co-national assistant teachers assisted both learners and teachers. AILs and local learners both had opportunities to interact with helpers from different language groups in positive ways that promoted diverse learning. Support for AILs in coping with learning in a new environment came from more capable and knowledgeable peers and teachers, which complemented the content and maximised learner performance with varying degrees of LoLT proficiency. Santamaria (2009:243) found that "learners learned very quickly and succeeded in their classrooms even for the most academically challenged learners if assisted by more capable peers and teachers". A particular teacher, Mr Maomanii from school B, stated that:

> *Calling parents and former students to school to assist learners in the learning of mathematics word problems was a successful way in our school. These elders were able to communicate with the African immigrant learners in their home languages to explain the concepts in mathematics word problems.*

The programme encouraged learners to change their mind-set and motivated them to like schooling. Co-national learners had a chance to share their life experiences at school and learn how to cope with challenges presented by learning in a new country. Interviewed teachers from school B reported that, after intervention by co-national assistant teachers, they noticed an improvement in learner performance when dealing with MWPs expressed in the LoLT. This strategy resulted in learners being able to read dual story books (Cummins et al., 2005). Cummins et al. (2005) recounted that in Canada parents and community members were invited to school and used the library for reading books to their children in their home language as well as in English. Consequently, Cummins et al. (2012) found that a new learner from Pakistan was able to transition swiftly into the new school environment without problems and was able to do her mathematical work well because her teacher was of Pakistani descent and was fluent in her home language of Urdu.

One of the interviewed learners, Rana from school B, stated that *"The moment I hear a teacher who communicated in my language, I was excited and happy and asked the teacher to assist me as he knew our language and could explain better in my language".* This teacher assistant was helpful as an interpreter, counsellor, and a guide for foreign learners. He motivated immigrant learners to try to use LoLT so that after a while they could read and write better. The co-national assistant teachers were able to convince learners to appreciate the use of English; the benefits and reasons for using it in their education. A teacher, Mrs Ihoe from school B expressed that:

> *We are not having a lot of problems in teaching these immigrant learners now as before as we are working with refugee agencies like the Agency for Refugee Education, Skills Training and Advocacy (ARESTA) that have programme to integrate these learners into the school community. They have tutoring and afterschool classes to assist these learners. We also have parents who are good in mathematics who are from the same countries with African immigrant learners who provide weekend classes to these learners in their home languages or by code switching so that they could not loose English or their home language completely.*

These findings were in line with the South African LiEP (1997) which advocates schools to use languages with non-native English learners in such a way as to promote additive bilingualism. This strategy helps these learners to understand taught concepts better. Some of the teachers in this study experienced challenges in their first days of teaching AILs. Mrs Ihoe from school B averred that:

> *We experienced problems during the first days of enrolment but later it was easy because we have a programme that assist such type of learners. We group them and ask assistant teachers from their countries of origin to teach them. This is one of our strategies we have adopted. After these programmes these learners are able to cope with the type of curriculum we offer. We also have reading, debating programmes where we encourage learners to share information, by doing so they will be learning and gaining language (LoLT) proficiency. It is not only African immigrants, we also have some from Bangladesh, Pakistan and China.*

Peer support networks were established at school B. These networks provided an immediate outlet for AILs to express their learning experiences. From classroom observations, it was reported that peer support networks allowed learners to affirm one another and to form a community in which they could openly share their learning experiences Gidersleeve (2011). This success shed light on the idea that while education is structured as an individualist endeavour, many AILs were actually interdependent and engaged socially while working on MWPs. One teacher asked former learners to share their learning experiences with participants so that new learners could cope with the learning challenges they were experiencing. If learners have no experience of working in a diverse group, they are reluctant to participate in one. Some learners might have been used to working in large classes where teachers do not use small groups that facilitate learner-to-learner interactions.

5.8. Group work strategy

Some of the teachers were observed while using group work as a teaching strategy. One interviewed teacher, Mr Roca from school B stated that: "*I used group work to assist immigrant learners when I mix them with local learners but, sometimes it does not work as there will be*

less or no communication taking place between locals and immigrant learners. It's like I am teaching them to communicate and not mathematics". This teacher's experience revealed that pairing or grouping AILs with more linguistically advanced peers encourages collaboration and cooperativeness among learners. Some teachers were observed to be doing their level best to incorporate AILs and local learners so that they could share mathematics knowledge and skills; specially to encourage immigrant learners to learn the LoLT from local learners. In support of the above ideas, Mr Maomanii noted that group work was important because it allowed learners, local and immigrants, to interact by using academic language of mathematics in a non-threatening learning environment; since small groups encouraged learners to practise and reinforce skills and concepts at their own level of proficiency. These experiences are in line with the aim of DoE (2011) to produce learners who are able to work effectively with other team members. Communication challenges were encountered when AILs were incapable of communicating in the LoLT. Some of the immigrant learners tried their best to work with fellow learners, but as one of the interviewed teachers, Mrs Muchova from school A stated: "*it is very difficult to teach African immigrant learners mathematics word problems, it is also difficult to complete the tasks, even though the locals try to assist them during group work, the local learners become bored and reluctant to assist these African immigrant learners because of lack of competence in the LoLT".*

It was difficult for AILs to participate in group work discussions or presentations since they were unfamiliar with the teaching approach of group work to learning; they lacked interacting with local learners. One immigrant learner, Chinjo from school A stated that: "*I hate to work in groups, I sit and keep quiet because I do not understand what the locals say and I cannot speak English and their language. They use their mother language so; it is the same as if I am not taking part in the discussion*". Brown et al. (2006) reported that refugee learners from Sudan were reluctant to participate in group work activities with local Australian learners because of language barriers. In this research project, local learners were observed to use their local languages which the AILs were unfamiliar with, so they kept quiet. This action could indicate that AILs did not cooperate with local learners; however, the language (LoLT) was the most challenging factor for communication (Planas & Setati-Phakeng, 2014). Group work was regarded as a new experience; even by AILs with previous knowledge of MWPs. Teachers could promote acquisition of mathematics concepts by using learners to listen to each other during discussions, so creating a comfortable learning environment in which learners express their ideas freely.

One teacher, Mr Watso from school A, stated that:

> *To tell you the truth, these immigrant learners need a lot of help, it is tiring to teach these learners, they always ask for help, from the capable ones (local learners and teachers) which means that there is always a conflict of interest among local and African immigrant learners when working in groups. By this it makes immigrant learners more confused and feel unwanted or uncared by South African learners and the teachers.*

Too many requests for assistance from teachers and other learners in every aspect of the classroom could result in immigrant learners becoming frustrated. One interviewed learner, Lube from school A stated that:

> *It is very difficult to discuss with local learners because we do not know what the statements say, it makes matters worse we do not know English. I wish, I could learn in a class that offers my language or be taught by a teacher from my country so that he or she can assist me or show some care and love for me to learn mathematics and pass, as he or she knows my challenges better than the local teacher.*

Another immigrant learner, Muthuli, stated that: *"No one wanted to work with me in their groups, I just sat doing nothing during group work, and the teacher did not even assisted me to work with others as a group".*

The findings showed that AILs faced significant challenges in working with local learners. For learners to be able to participate in mathematics classes, teachers need to consider the advice of Vandeyar and Vandeyar (2012:157) "when evaluating immigrant learners' academic performance this borders on the congruence existing between teaching styles used by their teachers back home and in their host society". When interviewed, Mr Erdan reported that tension between AILs and local South African learners was inferred from the way they responded to each other, the withdrawal syndrome of AILs in classroom participation and in their lack of interaction with locals. Classroom observations revealed that AILs had no or little interaction with local learners, since some of the observed teachers were not promoting group work even among co-nationals.

5.9. The effects of teachers' teaching pedagogies

Some teachers lacked instructional skills that catered for the needs of diverse learners, leading AILs to feel that these mathematics teachers did not make enough effort to teach them as they

had been used to in their countries of origin. One immigrant learner, Chinjo from school A stated that: *"What our teacher does is to sit and read the newspaper, busy with phone, he just gives a page to open and write the work without explanations, no marking, no assistance and no corrections, how can we pass without a teacher teaching us".* Some AILs claimed that their mathematics teachers did not explain the unfamiliar mathematics terms or vocabulary to them. Another immigrant learner, Abdullah from school A, stated that: *"sometimes I get new and difficult words in mathematics word problems that I do not understand but the teacher does not try to explain and he just refer us to use my home language dictionary and search on the internet which I do not have".* Such teacher advice was a considerable challenge to learners who did not have sufficient learning resources at home. Sofo et al. (2013) advised that teachers should provide unblemished and overt directions to ensure ideal learner engagement; particularly from recently arrived learners.

The observed South African teachers from school A lacked basic teaching skills for teaching AILs. I observed that some teachers from school A were not able to promote a conducive learning environment for diverse learners. African immigrant learners were largely silent in class and their reticence was taken to mean either that (i) they were not confident in general oral English or (ii) a teacher-centred style was being used that granted the teacher authority and obliged learners to be passive. Learners were routinely seated individually and were not allowed to work in groups or pairs; they were seldom allowed to ask others next to them for assistance. There was evidence of a traditional teacher-centred approach, which did not promote effective or optimal learning. African immigrant learners showed that they were left out since the teacher was always excessively talking. African immigrant learners could not understand the LoLT properly; so it was increasingly difficult for them to grasp the MWPs. It was difficult for AILs to respond when the teacher asked them questions. Due to their limited English proficiency, it was hard for some of the AILs to excel in MWPs as described earlier, even if they studied harder. Some interviewed immigrant learners stated that their teachers used conventional teaching methods, such as textbook-based lecture and teacher-centred approach, which did not promote learner involvement or engagement. It was observed that some of the teachers rarely modified their teaching styles, and did not consider educational backgrounds of AILs. Teachers need to vary their teaching methods to cater for all learners. In school B, however, some teachers were most helpful and applied different teaching and learning methods in their classes. This assistance was in line with what one of the interviewed learners, Rana from school B confirmed: "*In our country, the teachers were not always available to help us, but here teachers are helpful*

and always available and willing to assist us". In one class with small class numbers the teacher was observed to be assisting learners when working in groups or individually.

The findings revealed that the teaching methods and teacher-centred approaches were monotonous and might have prevented learners from developing interest in learning MWPs. That remark was in line with the finding of Choi et al. (2011:11) that: "Learners confessed their disappointment that their mathematics teachers did not seem to care about what they, as new immigrants, wanted and needed to learn, what concerns they might have, or at least whether they in fact were learning something in their mathematics classes". One teacher, Mrs Mwesto from school A said *"these learners are not able to read or write in English or even in their home language".* That sentiment revealed that some teachers assumed that AILs were incompetent in English without assisting them to improve their grasp of English.

Teaching methods involving self-discovery as used by new teachers could confuse new AILs if they only had been used to having assistance from their teachers in their countries of origin. If AILs did not appreciate that the teacher was giving them a chance to discover and think imaginatively, AILs could assume that the teachers were not being helpful. For example, one teacher Mr Roca at school B, wanted learners to think individually or be challenged with the difficultly and then rescue them by providing guidance. In some classroom observations at school B, teachers were seen to be providing waiting time in which learners could learn, think, and emerge with ideas and solutions that could be used in class discussions. Teachers of AILs need to be aware that their teaching methods might be misunderstood by immigrant learners. One participant teacher, Mr Roca from school B stated that: *"As a teacher, I give learners more time for interaction and allow them to come up with solutions and explanations of their thinking as there is promotion of language development but at times the immigrant learners seem to be reluctant to think.* This statement implies that while teachers may apply different teaching and learning methods, AILs might misinterpret what their teachers are doing and so not benefit optimally from the well-intentioned lesson, or gain independent skills and creativity and become innovative and confident in solving MWPs. Finally, immigrant learners should be taught and guided to distinguish between every day and mathematical language for them to be successful in manipulating MWPs.

Interviews revealed that AILs were used to doing mathematics in their own home languages and often with a strongly teacher-centred approach; in contrast to the learner-centred approach

in their new education system, leading to clashes in the expectations of immigrant learners and their current teachers.

5.10. Teacher competence in teaching mathematics word problems

In some class observations the teachers and learners in this project were seen to be able to engage in mathematical talk that promoted learners' understanding of mathematical concepts. During one classroom observation the teacher, Mr Roca from school B explained the terms *consecutive, treble, twice and more than* with the use of examples and allowing learners to come up with their own examples that included these terms. The lesson was so stimulating that it advanced the acquisition of mathematics language and vocabulary by both the teacher and learners. However, not all observed teachers, such as those at school A, clarified or explained the mathematical vocabulary used in MWPs. In some classes at school A, the teachers themselves had challenges in understanding the MWPs and were not able to explain the mathematical concepts clearly. Some teachers appeared incompetent in their understanding of mathematics content and lacked professional development (Cochran-Smith, 2008). The DoE should have an in-service professional development programme to keep teachers updated with current content in mathematics education.

Most teachers interviewed at school A were not knowledgeable of the needs and challenges faced by immigrant learners and so were poorly equipped to serve their needs. Wright (2010) argued that teachers of immigrant learners needed to understand the historical learning background or prior learning experiences. This sense is echoed by the results from class observations that most teachers from school A were not aware of the African immigrant learners' learning backgrounds.

Interviews and class observations showed that teachers from school A often concerned themselves little with learners' understanding of concepts but instead focused mainly on finishing the syllabus according to the DoE requirements. One teacher, Ms Mdamanest from school A stated that:

> *I find it difficult to teach mathematics word problems as per time allocated according to the DoE because foreign learners have LoLT challenges with understanding this topic. Mathematics word problems seem to be a challenge for these learners. I am also not well competent in teaching mathematics word problems as I did not do Mathematics at tertiary. Therefore, I focus on the arithmetic problems which may be easier and straight forward so that I can*

> *complete the mathematics content as required by the DoE. I also give these learners more questions to do on their own so that I can cover the required content in time.*

These findings show that the teacher had preconceived ideas or beliefs based on prejudice about foreign learners' potential in learning MWPs. The teacher-centred, watered-down approach by the teacher underestimated the abilities and potential of the immigrant learners. Moreover, this sentiment was congruent with that expressed by Melville et al. (2011) who found that some teachers themselves lacked sufficient substantive and content knowledge, since they had limited experience of the curriculum.

5.11. African immigrant learners' attitude towards mathematics

In many cases, the way AILs approached mathematics was encouraging and motivated local learners. Some of the observed AILs exhibited perseverance in their learning of MWPs. These findings supported Civil's (2008) finding that immigrant learners bring with them untapped knowledge and culture that helps local learners in their learning process. One teacher, Mr Roca from school B reported: *"it was easy for me to work with African immigrant learners as they cooperate well. They were disciplined, I loved them. They were doing my work even if they experienced challenges they came and asked for assistance".* These results revealed that the AILs were disciplined and persevering in their learning of MWPs despite their challenges presented by the LoLT. These learners were free to ask for assistance from their teacher, who in turn gave them support. One of the interviewed teachers, Mr Maomanii from school B averred that:

> *South African learners' mathematics is lagging behind that of immigrant learners in general because they (SA learners) consider mathematics as a feared and difficult subject which is a bad mindset. These learners fear and loose interest. They do not want to work harder and persevere. Immigrant learners show perseverance, they have a positive attitude about mathematics in general despite their challenges in mathematics word problems. They always practice and ask for assistance.*

African immigrant learners seemed keen to learn under any circumstances. Some AILs took mathematics as a subject that needed to be worked on with perseverance and patience and regarded it as important for their future careers, leading to them performing better than their South African peers.

The attitude of learners towards their teachers has a considerable influence upon their performance (Barton & Barton, 2005). These learning attitudes or cultures may be in the form of commitment, passion for learning, respect for one's teacher and personal humility. According to Samuelsson and Granstom (2007), immigrant learners frequently regard failure as associated with shame and guilt; however, in this study failure was seen as motivation for perfection. One of the interviewed teachers, Mrs Ihoe from school B, had this to say about the attitude of immigrant learners towards learning of mathematics; "*meanwhile, many newly arrived learners learn English shockingly fast. Even though, there are some who are struggling but the majority of these learners are keen to learn and always ask for assistance. They always like to learn and discover*".

One learner, from school B stated that he was shy and felt left behind during the learning of MWPs despite his teacher's effort to assist him. When asked about how they coped in mathematics classes, learners stated that some of their teachers always assisted them after school to understand. Janice claimed that: "*we always go to the teacher after school to ask for more clarity. Luckily my teacher (Mrs Ihoe) is a lovely one she always help us where we have learning problems when she is free*". Although these learners were faced with many challenges, they were dedicated to learning of MWPs especially those who revealed their attitude to the teacher by arriving up early and staying after school. Some learners believed that the learning of mathematics was more important in their new country than in their home countries. Most interviewed immigrant learners were dedicated to doing mathematics because they believed that mathematics grants access to many opportunities in their lives. Their attitude towards MWPs was believed to be influenced by their degree of self-esteem and by their teachers' teaching approaches.

5.12. Teachers' perceptions about African immigrant learners' mathematics attitude

One interviewed teacher, Ms Mdamanest from school A stated that:

> *My perception of immigrant learners was that they are not capable of doing mathematics. I underrated them, however, in general mathematics they are so good they only experience problems when using mathematical language, which is a problem with all learners but more on these African immigrant learners.*

Another teacher, Mr Roca from school B pointed out that: *"With the arrival of African immigrant learners they have brought a positive attitude towards learning of mathematics, hard*

work, which is assisting my South African learners to emulate and work harder". Some of the interviewed teachers held a negative attitude towards African immigrant learners' mathematics capabilities. According to an interviewed teacher, Mr Watso from school A:

> *My first few days when I had these learners (first week of January). I thought they had learned mathematics in English. I did notice when I gave them mathematics word problems for them to read and to solve. These learners struggled a lot in reading and explaining the meaning of mathematical words to interpret what the question meant. That is when I understood them and had to talk to them personally and then found out that some did mathematics in French.*

Vandeyar et al. (2014) noted that in SA, teachers often treat immigrants as if they were black South African learners. This shows how teachers who do not check the learning experiences or backgrounds of their learners could lose these learners in the learning process, since their previous learning experiences and background are used to build new concepts. Wright (2010:30) recommended that "teachers also need to know their learners' cultural backgrounds and how culture influences learning at school". Similarly, the Organisation for Economic Co-operation and Development (OECD) (2005:3) stated that "teachers should regularly update their knowledge base to improve their practice and to meet new teaching demands". One teacher, Mrs Ihoe from school B, stated that:

> *I always allow immigrant learners to express or use any method that they know to solve particular questions. I will then evaluate and assist them. I am always researching, these learners keep me busy so that I become a life-long learner. I have to search if the mathematical methods they use are appropriate to manipulate given questions. Sometimes I ask knowledgeable (foreign teachers) people from their countries. By doing more research I prevent confusion of underrating the African immigrant learners' knowledge which could result in demotivation of these learners.*

Mrs Ihoe from school B reiterated that: "*I found that multiplication and subtraction were done differently in other countries. I had to ask these learners to explain so that I could understand and use it as an appropriate method for South African learners too".* Cummins et al. (2012:39) suggested that "in order to teach the whole child in our increasingly diverse school systems we need to connect with students' lives outside of school and value the academic knowledge and cultural experiences they bring to the school". Drawing upon African immigrant learners' knowledge could help South African learners to gain new methods of doing mathematics. A teacher, Mr Maomanii from school B justified this initiative proposed by stating "*All immigrant*

learners are capable of doing mathematics. My perception is that they are always brilliant". This teacher explained that, despite some of the African immigrant learners being shy, they were capable of answering questions; besides a few who are shy but confident in a one-to-one context. This expansive or positive outlook for mathematics education is in line with the DoE (2011:8) position:

> *Teaching and learning of Mathematics aims to develop confidence and competence to deal with any mathematical situation without being hindered by a fear of Mathematics, an appreciation for the beauty and elegance of Mathematics and a spirit of curiosity and a love for Mathematics.*

5.13. Teacher qualifications and preparation for teaching immigrant learners

Five out of the 8 participating teachers at school A, were found to be poorly prepared or experienced for working with African immigrant learners **(Appendix G).** One of the teachers, Mrs Mwesto from school A claimed that: "*I don't have experience of teaching immigrant learners, but I have such learners in my class, what should I do then, and no assistance from the DoE, and even from the school itself. It is a one man's journey that I am travelling because of teaching mathematics".* Mellevile et al. (2011) echoed the above findings and noted that teachers encountered daily challenges in their teaching careers without any continued support. In addition, the increase in number of new AILs increased the challenge presented by these deficiencies. According to Moschkovich (2007:95), "teachers should develop approaches that support mathematical reasoning and sense making for learners because of the new LoLT". OECD (2005:3) iterated that "teacher quality itself is an important factor in determining gains in student achievement". Immigrant learners need access to curricula, instruction and teachers proven to be effective in assisting these learners' academic success. The DoE may not make available special teachers for immigrant learners. Some teachers were not able to teach immigrant learners effectively because they did not have required experience in teaching mathematics.

During classroom observations I found that some teachers did not look at the mathematics content, for example, new mathematics vocabulary before teaching the learners. They did not deconstruct the text to be appropriate to the learners' level of understanding. Mr Watso from school A did not allow learners to read or express understanding of the text. He did not teach from the learners' prior knowledge or even find out from learners what their perceptions about the topic were by asking questions, to check for the assumed knowledge. The teacher did not engage learners optimally in using basic mathematical language, which would have enabled

them to explore more advanced mathematics concepts. In support of these findings the Ontario Ministry of Education (2011:4) stressed that "knowledgeable educators recognize that although young children may have a beginning understanding of mathematical concepts, they often lack the language to communicate their ideas". If learners had indeed had exposure to previous content, teachers could start teaching learners from the concrete to abstract. Teachers need to connect mathematics to the outside mathematics world by modelling and fostering learner talk using mathematical language so that learners can articulate their mathematical ideas. For example, immigrant learners might have their own ways of doing mathematics and teachers should allow them to explore these avenues. Teachers could check learners' methods of doing mathematics by analysing their work while marking and later ask these learners to explain why they solved or manipulated MWPs the way they did. Such an opportunity for learners to explain their thinking promotes teacher understanding of learners' use of different methods of doing mathematics. Mathematics teachers should help learners in the process of mathematization to make meaningful connections between real world and formal mathematics. Similarly, Ontario Ministry of Education (2011) stated that knowledgeable teachers assist learners to transform their informal mathematics to formal mathematics, which can then be transferred and applied in different situations.

African immigrant learners might have been used to being spoon-fed with information by their teachers in their home countries. Their previous teachers might have used a teacher-centred approach; where the teacher was seen as the source of knowledge and learners as recipients or banks to be deposited with information (Freire, 1996). As one AILs, Ababa from school B stated: "*Our previous teachers in our home country read, directed, assisted and solved questions for us when doing mathematics in my language*". In such a case, learners could have depended too much upon their home country teachers for their learning of mathematics. Their previous teachers were perhaps giving much attention to guiding learners without giving them opportunities to explore and become independent promoting creativity and critical thinking.

Some of the participating teachers had fewer than 4 years of experience teaching mathematics in the teaching profession, as shown in **Appendix G.** More than half of the participating teachers, 5 out of 8 reported that mathematics was not their major subject; but due to staff shortages they had been given a mathematics class. This is in agreement with past research conducted by Wright (2010:27) who reported that "English language learners are most likely to be assigned to a novice teacher and at the secondary level, they are more likely to be taught by teachers who lack expertise in the subject they teach, that is teachers without a major or

minor in that subject". Such teachers would naturally face challenges in teaching diverse classes because they lack experience and support from the school and the DoE in particular. One teacher, Mrs Mwesto from school A, noted:

> *The major problem we have is that we are all new from the university and using that little knowledge we have, we did not have any training in teaching this group of learners (African immigrant learners) and we then meet this new group of learners and we are not experienced and cannot be able to teach them effectively, and not majored in Mathematics.*

Another teacher, Mr Watso from school A, stated that:

> *This is a problem to me, the principal just gave me this class, I even told him that I cannot teach in English only because I did Mathematical Literacy and IsiXhosa being my major subject and he refused and forced me to teach this class. Now I meet these foreigners, they cannot speak or can barely speak simple English (basic) what about mathematical terms in mathematics word problems.*

It seemed that SA had few or no specialist teachers of ELLs and no strategies for helping specialist teachers and mainstream teachers of immigrant learners to work together. One teacher, Mrs Muchova from school A asserted that: "*I am doing what I can because I cannot help them the way they want me to. This is too much demand from me. This is my first time to teach such type of learners on top of that its Mathematics and I trained to teach History and Life Orientation*". Some of the interviewed teachers suggested that the DoE should provide them with training or workshops on how to teach such diverse classes containing non-South African learners. This observation is in line with the experience of an interviewed teacher, Mr Watso from school A, who claimed that: "*I am new in the teaching so I have not yet have a situation of teaching a class with foreigners and Mathematics. This is a challenge to me. How am I going to cater for their learning needs"?* Learners were able to notice that their teacher lacked confidence in teaching mathematics word problems. One learner, Simbe from school A, affirmed that:

> *Our teacher struggles a lot in solving mathematics word problems, he makes us more confused. I think he is not qualified to teach mathematics because the answers that he get are different from the ones we have at the back of our textbooks, I even asked another teacher to solve the mathematics word problems for us after school and he got the answers that are in the textbook. I can't trust my Mathematics teacher anymore.*

The above statement is corroborated by the interview results that Mrs Mwesto conceded:

> *I am having challenges with mathematics word problems and cannot teach it confidently, therefore, I just give learners to do on their own and does not provide feedback. I am not good at mathematical word problems, so I skip or ignore some of the difficult mathematical terms as well as word problem tasks. I did not train to teach Mathematics at university but I was given Mathematics, I am qualified to teach Mathematical Literacy and Life Sciences as they were my major subjects at university.*

Some teachers were teaching Mathematics although they were only qualified to teach Mathematical Literacy (**see Appendix G**) as principals thought they can teach Mathematics. Ball (2008) emphasised that learners' achievement was significantly related to teachers' mathematics knowledge, thus if teachers are not knowledgeable in mathematics the learners will not do well. This finding supported that of Pettit (2011:6) who claimed: "Many teachers are graduating from their certification programs without the training they need in second language acquisition required to be successful in teaching English language learners". In these cases, effective and efficient supervision by School Management Teams (SMT) seemed to be missing. Bonenfant (2012) advised that with the present influx of immigrant learners from a variety of countries, teachers need to be both qualified and certified to teach this type of learners if they are to promote a higher level of academic achievement amongst learners. A teacher, Mr Watso from school A, pointed out that: "*I have no idea as to cater for this group of learners (African immigrant learners) as I do not have any skills for teaching such type of learners".* Most teachers had been equipped to teach local South African learners only.

It was found during interviews that some teachers did not hold teacher training degrees or had completed teacher education courses in different programmes but came to be employed as mathematics teachers **(Appendix G)**. For example, one of the interviewed teachers, Mr Erdan from school A, had not undertaken education courses because he had a BCom Economics as shown in **Appendix G**. This teacher was not able to cater for diverse learners in his teaching and learning process (Lucas & Villegas, 2013). Some learners were excluded from the teaching process; without their questions being answered or without proper explanations of the concepts under discussion. When interviewed, Mr Erdan had this to say when asked about his experiences in teaching diverse learners:

> *I am having a problem of accommodating all learners because they have different levels of understanding, some do not understand the LoLT and some are very slow in their*

> *learning. I did not do teaching course and it is a challenge for me to teach these learners. Sometimes I just continue teaching even if they do not understand so that I can cover the curriculum as required by the DoE.*

Most participating teachers reported that they had not been prepared to teach African immigrants (Schmidt, Cogan & Houang, 2011). The challenge was that immigrant learners were in some schools where learners were in mainstream classes or English language classes. This enrolment pattern created a great challenge for both teachers and AILs who needed more time especially in the use of the new LoLT. In the same vein, Wright (2010:19) stated that many learners; "may be forced into mainstream classrooms even though they lack the English proficiency necessary to succeed in them". Mr Watso and Mrs Mwesto confessed that they were not comfortable with teaching MWPs since they did not train in mathematics at university.

The DoE needs to provide qualified teachers for immigrant learners and other learners who require extra attention in terms of the LoLT (Lucas & Villegas, 2013). There is a need for the DoE to work together with the teacher training Universities to train specialist teachers who can address the needs of AILs such as bilingual teachers, ESL or special teachers for immigrant learners. Frequent supervision needs to be undertaken by the principals, head of department (HOD) and DoE, to assist AILs in the learning and teaching of mathematics.

Wright (2010:3) noted that: "many teachers have not received adequate training in how to effectively address the academic, language, literacy and learning needs of ELLs". Teachers need training to address the issue of diversity in their classrooms and in the school as a whole. Candy (2009:8) advised that teachers should be given staff development on how to meet the needs of all learners; including ELLs and immigrants, so that they may achieve equity and excellence and achieve academically. It is not just in SA that LoLT issues arise, as Ji Yeong, Chang and Son (2019), Kim and Kim (2012) reported that in Korean schools, teachers were unprepared to cater for multilingual learners in their learning and teaching process. However, some teachers, from school B, interviewed in this study stated that they had been trained about multilingualism in some educational courses which were not mathematically oriented. However, this training helped them to support the AILs with some strategies in learning mathematics.

5.14. Teachers' pedagogical skills

Because participating South African teachers did not share a common home language with immigrant learners, they could not resort to CS. Some teachers were reluctant to ask for assistance from more knowledgeable others (MKOs) and skilled teachers or teachers of ELLs. OECD (2005:3) stated that "pedagogical knowledge refers to the specialized knowledge of teachers for creating effective teaching and learning environments for all students". One teacher, Mrs Muchova from school A, stated that:

> *I don't know how to cater for these learners, and I do not have any skills of teaching foreign learners. I do not bother myself about asking other teachers. Even if I ask for assistance from the principal, I know that there is nothing he will do as he said that we should see what to do as this is a challenge to the school and no one is experienced to teach such learners.*

Mr Watso from school A stated that: "*I do not know why the principal enrolled these learners? Did he check their records for previous Grades? May be that is why these learners are having problems with mathematics".* A learner Muthuli from school A, when interviewed stated that: *"I lied about my Grade and said that I did Grade 10, now I am struggling. Please do not tell anyone that I lied".* One of the challenges that teachers encountered was that some learners used fraudulent documents because they were illegal immigrants. There could then be a gap between their documented and actual mathematics background. One teacher Mr Watso from school A, averred that: *"some of these learners have basic communication skills. They talk but cannot read or write properly what they are saying".* African immigrant learners present a particular challenge to teachers because in tackling MWPs, learners have to read and understand, interpret the questions so that they can devise the required solutions (Barwell, 2018). Cummins (1981) pointed out that while BICS are easy to acquire, the higher cognitive CALP is difficult to acquire because it is context demanding and mathematics language requires CALP. One interviewed teacher, Mrs Mwesto from school A stated that: "*They* (African immigrant learners*) may say a word and when you ask them the meaning or the symbol represented by the mathematics they are unable to write it down or define it or even identify the term"*. An interviewed learner, Simbe from school A stated that: "*I can speak English because my friends in the location or community assist me very much as we play together but cannot understand the English used in mathematics classes".*

Teachers have a duty to assist and teach formal language by encouraging and fostering the use of mathematical language in their classes so that learners may gain and acquire the mathematics

language for academic purposes. Consequently, teachers should have mathematical knowledge, skills and be able to impart to learners by unpacking mathematical concepts and make content visible to and learnable by learners (Ball, 2008). Teachers need training in how to work effectively with immigrant learners in the learning of mathematics; both in pre-service education and in continuous professional development (Deussen et al., 2008; Lucas & Villegas, 2013). However, interviewed teachers reported that they had not been purposively trained by the school and the DoE with the appropriate curricular materials to promote better learning for AILs. A teacher should try to develop a learner-focused teaching and learning environment as well as learn to use different learning and teaching approaches according to the type of learners in their classes.

The manner in which teachers approach and implement their day-to-day lesson delivery should be in line with the needs of learners and AILs in particular. Teachers should be able to know and understand how to use the most appropriate teaching methods for the benefit of immigrant learners and the entire learner composition in their classes (Kim & Kim, 2012). Yet the findings of this study revealed that teachers of immigrant learners did not receive special university training to cater for these learners. One teacher, Mr Watso from school A, advised that: "*It will be beneficial for teachers to be trained to teach immigrants or schools should have special teachers to support other teachers in teaching these diverse learners in schools*". Thus, for teachers to gain mathematics teaching knowledge requires access to mathematics knowledge and practice as well as being able to apply it to learners (Ontario Ministry of Education, 2011).

5.15. Classroom interaction: Teacher-learner interactions

Cultural beliefs about teacher-learner interactions or relations contributed to the silence of AILs in mathematics classes. More than half of the learners or 12 out of 14, were too intimidated or shy to interact with the teacher; especially girls from Somalia. One learner, Ema from school A, reported that: "*We are not allowed to talk to elders and seat next to them even to have physical contact. Therefore, we keep a distance as it is our culture".* This attitude could affect learners' performance in MWPs which demanded considerable assistance because of the new LoLT and the mathematics vocabulary. African immigrant learners mentioned a variety of reasons why they were reticent when learning MWPs. One AILs, Simbe from school A complained that the teachers refused to assist him and claimed that he was too lazy to read for himself. Several AILs complained about the cultural insensitivity of some of the South African teachers in the learning of MWPs and averred that they preferred culturally sensitive teachers, who respect learners' culture and consider them as human beings. Such learners claimed that

these new teachers did not acknowledge their presence. It was observed that most teachers from school A had little or no interaction with AILs. These findings were in agreement with those of Van Manen (1990), that learners' experiences arise from their lived social cultural and historical contexts and that they learn from active involvement in their immediate environments.

Low level of LoLT and ignorance of the South African system of education made it difficult for foreign learners to have good interaction with teachers. Most participating learners felt that they needed communication with the teachers but believed that some teachers were unwelcoming. Some teachers were indeed clearly unwilling and uncaring of their African immigrant learners' education.

Some AILs were uncomfortable when interacting with their teachers because they had limited LoLT proficiency. When Simbe from school A, was interviewed about her interaction with her teacher she stated that: "*I was separated and put in a classroom that did not recognise me maybe because of my bad English*". These findings were corroborated by classroom observations that the sharing of information in the classroom was often not inclusive and interactive. However, some teachers and learners at school B did have good relations which promoted effective learning for AILs. One learner, Rana from school B, stated that:

> *I like our mathematics teacher, he always assist us when we approach him. He is friendly and act as a parent to us. He goes to an extent of asking about our social life like food we eat and if we have eaten. He cares so much that he even called my father to discuss about my performance first term of my studying here in South Africa. I was not able to speak or read English statements. I was able to get a tutor from our country who was found by my teacher to help me with my school work.*

The care Rana received was different from what their previous teachers in his country of origin had given. A teacher, Mrs Ihoe from school B, stated that: "*African immigrant learners had an attitude of making sense of mathematics word problems and persevere in solving them"*. She continued to aver that: "*African immigrant learners are my best learners they are intrinsically motivated, they have a culture of learning, and they go an extra mile with their work despite having challenges with mathematics word problems".* The use of co-national assistant teachers or foreign teachers at school was a good teaching practice which assisted immigrant learners understanding MWPs.

Another teacher, Mr Roca from school B, remarked that: "*What I like about immigrant learners is that they are willing to learn and they try their best they also study on their own and study so hard to succeed*". This was substantiated by Mr Maomanii who claimed that:

> *Most newly arrived immigrant learners like to learn as they learned English astonishingly fast and they improved their English as time progressed. After six months immigrant learners were able to converse in the informal language but having problems with the mathematical language however, there were some improvement as compared to the first months they arrived here.*

It is worth emphasising that some of the teachers at school B who participated in this study promoted integration of learners for good learner-learner interaction as well as teacher-learner interaction. They encouraged cooperative learning during group work activities and perseverance to learning of MWPs using the new LoLT.

While my findings suggest a pattern of integration among AILs and local learners I studied, there were some instances at school A where there was no collaboration among these learners. In some of the observed classes the teachers at school A complained that AILs were not cooperative and were reluctant to participate. One teacher, Mrs Mwesto from school A, stated that: "*I do not know any one of the languages of these immigrant learners except the local South African learners. I can only assist local South African learners when they have problems with the LoLT in mathematics word problems and translate or use code switching".* In this way the AILs were excluded from the learning and teaching process. Another teacher, Mr Watso from school A, reported that: "*There is nothing I can do, maybe we need teachers who can speak their languages, the DoE should build or make schools for these learners as they are a burden to us we are being stressed with these learners".*

While some teachers, most often from school A, were not able to cope with teaching multilingual classes with AILs, some immigrant learners stated that occasionally teachers were unhelpful about learners' problems; as stated by one that "*Our teacher, Mr Watso is not willing to help us so I always ask the other teacher after school to explain to me*". Some learners participated well despite the sentiments from local learners that they wanted to flatter the teachers and were *Magundwana* (Sell outs). Many AILs from school B, searched for support from teachers by conversing with them face-to-face after school during free time. One teacher, Mr Roca from school B, pointed that: "*I always call these African immigrant learners after school to provide support so that they cannot be left behind".* The teacher's support may have

helped because these learners were able to cope with the content and caught up with other learners in the learning of MWPs. However, some of the African immigrant girls did not attend these extra classes. When asked about their reluctance, one girl stated that they could not interact with men as their culture did not allow it. The teacher, Mr Roca from school B, affirmed that: "*This is a challenge to me as these learners are not performing well and are reluctant to be helped due to cultural beliefs".* Taylor and Doherty (2005) reported that immigrant learners were not able to interact with local learners because they encountered association problems when trying to acquire the LoLT during learning.

Most participating AILs felt that they needed communication with the teachers but that some teachers were unwelcoming. Some teachers at school A in their turn perceived AILs as unwilling and uncaring about their learning, without asking these learners about the challenges they faced. However, AIL were not aware of the level of participation expected of them from their current teachers, who were using learner-centred approach. Anthony and Walshaw (2009) concurred that interaction between learners and teachers, as well as between learners themselves, is a necessary component for stimulating thinking in learners. Some teachers at school B for instance, were helpful to learners; assisting them to understand the value of what they were learning and actively encouraging learners to work well through regular feedback and guidance as well as acknowledging and praising their achievements. As corroborated by results from classroom observations, some of the teachers at school B encouraged learners to learn for understanding. The relations between some teachers at school B and AILs were caring, friendly and encouraging; interactions were positive, helpful and good humoured, underpinned by a high level of trust in their teacher-learner relations.

In these well-run classes at school B there was adequate facilitation of conversations within the classroom about their different cultures and values, which provided opportunities for learners to develop empathy for their peers outside their typical social circles (Steinbach, 2010). As one teacher, Mr Maomanii from school B, stated: *"I assisted my learners to complete tasks in a conducive learning environment that was accommodative to all learners".* Moreover, Mr Maomanii commented that:

> *It's cool for me to see learners interacting and learning mathematics word problems from each other. There were ample opportunities for these learners to talk to each other and work together collaboratively as they networked, this interaction improved these learners' language and mathematical capabilities. In fact, I view immigrant learners as an asset to the mathematics classroom and*

> *school community and it is essential to have them in these classrooms as it promotes diversity.*

This viewpoint was corroborated by Janice who claimed that: *I now like doing mathematics word problems with local learners as I also make new friends who will assist me with my education. It was a great surprise for me being in a class with people speaking different languages from mine working with me, but 'black like me'. I was able to work with them nicely.* Janice had first-hand learning experience of learners of a different language but the same race: she enjoyed collaborating with all learners who were assisting each other with MWPs. Mr Roca confirmed that AILs added value to South African education when pointing out that: *"having diverse learners in my mathematics classroom encouraged better class discussion, communication, participation, positive competition which was very relevant as well as engaging*". These findings revealed considerable learner-learner interaction in some of the mathematics classes (school B), which resulted in greater learner participation, collaboration and sharing of mathematics knowledge and skills. The lived learning experiences of immigrant learners provided a way for mathematics teachers to learn about the importance of diverse learners in their classrooms. While some evidence of enjoyment and fun was observed among the immigrant learners after the intervention programme, there were instances of teachers complaining about these learners' interaction in their classrooms. For example, Mrs Mwesto stated that:

> *At the beginning of the year immigrant learners were too reserved, they did not want to talk or even associated with local learners, immigrant learners need to be isolated from local learners. They were too passive and were used to teacher-centred approach, however, the interaction of immigrant learners with local learners and me is better now as compared to the time they arrived.*

The majority of teachers agreed that building good relations with participating learners through understanding their educational needs and cultural behaviour was important for these learners' teaching and learning process. These teachers reported that participating learners needed acceptance to be able to participate well in mathematics classes.

Participating learners reported that being taught in a new LoLT was a challenge compounded by the new learner-centred methods of teaching. It was found that learners experienced a shift in the way they were taught in the new country. The findings from classroom observations indicated that learners struggled to understand the way teachers taught; they felt left out in the teaching process because they were used to traditional teaching methods in their countries of

origin. These findings recall the philosophy presented by Husserl (1970) that he considered himself as an eternal beginner and that real learning lay in doing. The majority of the AILs were trying by all means to deal personally with the situation by overcoming their fears, frustration, and anxiety of learning MWPs in a new country.

5.16. Teachers' role in mathematics classrooms

Participating learners compared local South African teachers to their previous teachers in terms of their roles as facilitators and their qualities of guidance, reluctance, being willing to assist, keeping busy, being rude, and being authoritarian. However, the responding learners described the roles of some South African teachers in different ways. Some claimed that they were helpful and good facilitators; able to assist learners in a step by step manner, had patience and loved to work with learners, particularly at school B. In comparison, some teachers in their countries of origin were reported to have been reluctant to assist and avoided learner support. One learner, Rana from school B, from the DRC claimed that: "*South African teachers are so helpful because they do not punish us or beat, they respect us as people, and I like to work with them because they are "smart". Our teacher is a free person because if I do not understand something in class, he will always assist us and does not become angry or bored with us*". These findings suggest that some South African teachers were helpful and keen to work with learners. These teachers at school B were encouraging, inspiring and respected learners' dignity by providing all that was needed for these learners to understand MWPs. By contrast, learner, Chinjo from school A, had this to say: "*My teacher is very rude and unhelpful, when you ask a question she will tell you to think and search for the answer and say that where were you when I was teaching, I cannot repeat what I said. Our teacher reduce one's spirit for doing or liking mathematics word problems maybe he does not like this topic*".

These contradictory reports imply that not all teachers were good teachers; some were rude to learners, were not assistive, accommodating, or tolerant; which could have resulted in immigrant learners being reluctant to learn. Reportedly, some teachers from school A were reluctant to assist learners and left them to do work on their own without assistance. The comparisons drawn from experiences of AILs, South African mathematics teachers and that of previous teachers of AILs from their home countries were indicative of attitudes and expectations that participants had towards their past, current and future mathematics teachers (Van Manen, 1997). One participating learner, Gumaka from school A, stated that: "*I am not performing well because the teacher is not assisting me as well as the local learners do not want to share information with me*". Another learner, Chinjo from school A, was interviewed

and reported that they went to the principal's office several times to complain about their misunderstanding of their teacher's teaching methods but instead the principal reacted by provoking further anger. These responses invoke a plea to some teachers to open their minds to the significant influence they might have upon their learners in the teaching and learning process. Such a plea was supported by Groenewald (2004) who noted interdependence between the self, others and objects in the world where individuals survive and experience their life-worlds.

The conversations in interviews conducted were centred on the lived experiences of the participating learners, about their interactions with the teachers. One participating learner, Simbe from school A, claimed that: "*I haven't had a chance to mingle and talk to my teacher"*. She acknowledged that her teacher did not seem to understand her as a learner who needed assistance to cope with learning in a new country. Muthuli from school A reported that they did not like to be taught by local teachers because these teachers did not effectively interact with them in mathematics classes. Further discussion with a learner, Muthuli, revealed that he recognised that his relations or interactions with the teacher were opportunities for development but the lack of development in her relations caused her to question whether her school work was of the required standard. With classrooms becoming increasingly diverse, it is indispensable for teachers to know how to work with AILs and foster effective communication in their mathematics classrooms.

5.17. Classroom interaction: Learner-learner interaction

This study sought to establish the nature of African immigrant learners' relations with their significant others or MKOs; that is teachers and other learners who could provide support and interaction. Communication or interaction with others by sharing information during the learning of MWPs was witnessed during classroom observations. Participating learners identified a lack of social relations with the MKOs. These learners were afraid of asking questions of their teachers or local learners. Some AILs did not have enough support from teachers; did not participate in classroom discussions and were reluctant to interact with other learners. Their situation was characterised by low level LoLT proficiency and lack of knowledge about needs of the South African system of education. The above findings are corroborated by the results from classroom observations that most teachers at school A had fewer learner-learner interaction opportunities in their classes.

Most learners who did not make connections with teachers and other learners, felt isolated and marginalised and stressed as stated by one of the participating learners, Muthuli from school A, that: *"I felt so isolated because I was not able to have teachers who could attend to my problems or even having a local friend to talk to".* These findings are in line with what one teacher, Mrs Ihoe from school B, stated that: *"I have seen that the African immigrant learners had frustration during their first days in my class because of lack of proper communication skills when discussing mathematics word problems and they felt left out because I did not always spoon feed them"*. Inter-subjectivity, interaction with others in the classroom, was apparent in some of the African immigrant learners' closeness with local learners, which seemed to give new meaning to these learners and afforded them strength, perseverance and a positive attitude in learning MWPs. Insights of experience, gained from those actually living and learning in a new country could provide new understandings to teachers and DoE about how best to meet with, be with, and support learners in their new learning environments. Through inter-subjectivity experience and connection with others, AILs gained an understanding of a new social world (Van Manen, 1997). Although the experiences of AILs in the learning of MWPs differed according to each individual, the respective ethnicity, culture and religion of AILs affected how they interacted with other learners.

This study found that relations between teachers and AILs and between local learners often left participating learners feeling isolated, frustrated, and doubting their ability to solve MWPs (Lee & Opio, 2011). Working together in groups or pairs was unfamiliar for some of AILs, being unfamiliar in their countries of origin; for example Somalian collaboration with other learners is not allowed; especially between males and females. A learner, Abdullah from school A, reported that:

> *We were not allowed to work together as boys and girls in our culture because men and women do not mix, therefore we cannot ask a female teacher to meet her in private during her free time. It is a taboo in our culture. Our teacher emphasized on individual work, our teacher always said that we should not talk or assist others "each man for himself" was our teacher's motto.*

Previous teachers did not allow learner-learner interaction because they emphasised individual effort. Ababa, a Somalian learner, emphasised that his new teacher, Mr Roca allowed group work which assisted them to read and work with local learners to improve their mathematics; however, their culture did not allow male learners to talk to females; making it difficult for them to be assisted by girls or by female teachers.

It was found that interaction with other learners occasionally provided a sense of comfort and belonging to the classroom environment for AILs, sharing information, working together to assist each other's schoolwork. Another learner, Rana from school B, stated that: "*I feel confident when speaking to others, even though my English is not perfect, my friends encourage me to continue talking, and they did not laugh at me either".* However, in another class a participating learner, Ema from school A, stated that: *"We usually do mathematics individually if you talk to someone next to you, the teacher will reprimand you, and he did not want us to work as a group"*. These findings were aligned to the observations of one of the participating teachers at school B, that learners were grouped and allowed to work in groups. Mr Roca from school B moved around checking for progress and maintained order to ensure effective and efficient learning. Some AILs in school A stated that their teachers did not allow group work. This is in line with what I observed with the seating arrangement as desks were arranged in rows and learners sat individually. Learners were not allowed to move from their places to ask someone next to them if they had problems. Chinjo from school A claimed that: "*Our teacher does not allow us to ask our friends if we have problems, he always wants us to think and use our brains also saying that we are lazy and noisy".* When Mrs Mwesto from school A was asked about the seating arrangements she stated that: "L*earners should be independent and able to work alone since in the examinations they work alone there is no group work, I have to train them now before they write examinations"*. These results show that some teachers were reluctant to allow group work in their classes in favour of learners' independence in their classrooms; making it impossible for learners to share or work together. AILs in such cases experienced a lack of lived social relations with MKOs or local learners (Van Manen, 1990). They felt barred from learning from others (Makoe, 2008). The lived social relations with significant others, or MKOs included issues of support and communication for social interaction as well as sharing mathematical skills and knowledge.

Some of the local learners at school A were unwilling and unhelpful to AILs; not wanting to interact with this group of learners, citing language problems and lack of knowledge. Interacting with local learners was seen to assist immigrant learners to acquire the LoLT. Johnson, Johnson and Roseth (2010) noted that when immigrant learners interact with local learners, they may be negatively influenced by engaging in truancy and crime, because they seek to conform to a group.

Some AILs mostly from school A asserted that they were not able to interact with local learners because the local learners were operating at a higher level; they felt uncomfortable to interact when manipulating MWPs. These respondents were withdrawn and only worked with other AILs of similar understanding and culture. One respondent, Simbe from school A, stated that: "*My English is bad therefore, I cannot communicate with local learners because they are better than me and they will see that I speak broken English*". The AILs avoided interacting with the teacher, fearing their incompetence in LoLT. The reason for AILs being passive in class may be due to shyness and fear of their LoLT competence.

5.18. Feeling invisible to teachers

Most AILs reported that their teachers were not paying them sufficient attention; focusing instead upon the requests of the local learners in their classrooms. Simbe from school A stated that: *"The teacher always assists South African learners, who are we to be assisted since we are foreigners and unseen by teachers. She does not see our presence".* During class observation, Mrs Mwesto from school A was seen to avoid a group of AILs while interacting with local learners who were busy solving MWPs. She tried to hide the fact that she did not attend to the AILs in her class by returning to her desk and engaging with her work. During the second visit to this teacher, Mrs Mwesto, it was again observed that she avoided the same group of AILs and paid attention only to South African learners. In another observed class, Mrs Ihoe at school B was seen to assist all learners regardless of their nationality or race, which conformed to the DoE (2011) policy of inclusivity. Gurazzy from school B stated that: "*Our teacher tries her best but, we cannot understand her because of the English, then it seems as if we are not being recognized as we see the teacher as not doing much to assist us".*

Generally, it was found that AILs were unnoticed, ignored or invisible in the education system; reinforcing their lack of self-worth as also reported by Van Manen (1997) and by one of the learners (Abdullah from school A) that "our *teachers do not pay much needed attention to us in the learning of mathematics*". These sentiments revealed misunderstanding between the teacher and AILs about these learners' learning challenges. Such teachers' avoidance of interactions with AILs contrasted with the findings of Antony and Walshaw (2008) that interactions are fundamental in stimulating and extending student thinking. Most immigrant learners at school A stated that their current mathematics teachers were selective and not accommodating when teaching them; especially during these learners' first arrival. Simbe stated that: "*when we arrived here my teacher didn't want us to speak in my language or even assist us when we struggle with word problems".* For example, the African immigrant learner, Noah,

was isolated from group work in his class; he was not recognised by local learners and the teacher (Mr Watso) failed to include him in the learning process. During class observations, Noah's facial expressions betrayed signs of loneliness, confusion, and awkwardness. When interviewed, Mr Watso argued that: "*by having immigrants at our school it could result in having foreign values which purports tarnishing of South African precious values".* In contrast, Mrs Ihoe, like all other participating teachers interviewed in the course of this study, deviated considerably from that preconception, asserting that:

> *I viewed the immigrant learners as assets to the mathematics classroom as they offered diverse mathematical knowledge to the South African education system. Local learners, immigrant learners and all teachers belong together because we are same people. We should not discriminate but love each other as human beings.*

These findings are in line with those of Suarez-Orozco et al. (2009) who averred that teachers were mistreating and not interacting with immigrant learners, due to these learners' learning backgrounds and cultures. Teachers and local learners should work together with immigrant learners, and not marginalise them.

AILs were often, literally segregated from local learners as well as appearing to be invisible to their teachers during the learning and teaching of MWPs. Mr Erdan from school A explained that:

> *My hands are full. I cannot assist learners who are completely incompetent. I cannot perform miracles, their parents or the DoE should look for a means to assist these learners because they need extra care and special classes if they should progress to the next Grade. These learners are totally empty; they know nothing about mathematics word problems in English.*

This pattern was observed by Lee and Opio (2011) who claimed that teachers avoided and discouraged learners from participating in class discussions. Such negative perceptions of these learners effectively deprived AILs of a decent education. Some AILs (12 out of 14) expressed that they would prefer to be taught by teachers from their home country so that when they encountered problems with MWPs these teachers could explain to them in their home language or with great care and concern.

5.19. Labelling and stigmatisation

Some AILs were labelled and stigmatised and told that they came to take South African learners' education, this stigma stifled their learning of MWPs. African immigrant learners reported that some of their teachers and local learners labelled them "Magweja" or "Makwerikweri" (pejorative terms for foreigner). Gumaka from school A stated that: "*We were given names to describe where we come from*". One participant, Danest from school A, stated that a local coloured learner uttered these words: "*Gweja, Dakkie, and Swart we cannot work with you, you think you are smart*". Despite reporting this matter to the teacher and even if the teacher heard the utterances, he took no action. This stigmatisation of respondents by local learners was seen as a bullying mechanism to isolate immigrant learners from the teaching and learning process (Lee & Opio, 2011). Participating learners felt disconnected and lacked support from their teachers. However, the ethnic stereotype played a more salient role in the participants' interaction with teachers and local learners. Observations in mathematics classrooms revealed stigmatisation of AILs when they were stereotyped as "out of place learners". This conformed to the description of illegitimate non-members of the school community as identified by Lave and Wenger (1991). Participating learners reported that they faced isolation, alienation, and lack of support from teachers, schools, DoE, low expectations from the teachers based on racial and ethnic discrimination as well as teacher bias and discouragement. The ethnic stereotyping led to frustration, anger and fear felt by AILs, frequently resulting in a hostile classroom environment. Some of the local learners from school A were xenophobic and unaccommodating, which increased the sense of insecurity among AILs when learning MWPs. African immigrant learners saw themselves as undeserving or unworthy to learn alongside South African learners. Teachers need to create good teaching and learning environment by taking responsibility of preventing stigmatisation (Lee & Opio, 2011).

African immigrant learners experienced ethnic-based assaults in mathematics classes when doing MWPs. For example, one observed teacher, Mrs Muchova from school A, was discussing MWPs using a graph with HIV, Malaria and Ibola infection data on different countries like Botswana, South Africa, and Congo. Mrs Muchova from school A asked a Congolese learner a personal question: "*You are the only one from Congo, and I think you are going to be able to answer this question about Ibola. So is it really true that Congolese people contact Ibola more than other countries because of chimpanzee, poverty and war*?" The learner was uncomfortable since it was a sensitive question directed to him, not to the whole class. The learner kept quiet and looked shocked by the teacher's action. When interviewed, the learner, Gumaka explained that: "*This word problem designed by the teacher made me stressed and I felt a little tense*

because I felt as though the teacher targeted the questions to me as if I have Ibola. Why asking about Ibola to me, is it that I have Ibola, the other learners will say I have Ibola. This teacher hate me". The learner even sobbed during the interview session because of what the teacher did to him. Such negative utterances could influence the relations of teachers, local learners and immigrant learners exposing immigrant learners to racism, xenophobia, intimidation, isolation, and powerlessness. Teachers should be aware of the consequences of their actions and perceive AILs as having negative attitudes towards themselves because of their ethnicity, race, nationality or gender. Generally, misunderstanding of culture and name calling were seen to be viewed negatively by AILs.

5.20. Discrimination

The study found that most AILs faced discrimination; leaving them feeling undervalued, developing negative self-concepts, low self-esteem and doubting their own self-worth. For example, a Somalian Muslim learner faced strong discrimination from one teacher. The learner, Mubarak from school A had this to say: "*What is perceived about Muslim people by the entire world (terrorist) like local learners did not associate with me*? *They think we are Talibans who kill people"*. The following quotation shows the level of discrimination endured by some of the learners. A Somalian learner, Abdullah from school A stated that:

> *When local learners told me that I am related to Bin-Laden because my surname is Bin-Laden, I fought with one boy when the teacher grouped us to do word problems together when he said that I was related to the terrorist Osama Bin-Laden. There are a lot of problems I faced from working with local learners. The teacher did not support me but took me to the principal and called my parents to school. Due to language problems my parents were not able to explain or talk well with the teacher, principal and the boy's parents. Then, I was suspended for a week. But, what can I do since I am a foreigner?*

This quotation reveals how immigrant learners experienced their learning in a new country as discrimination as well as being segregated. In addition to challenges in LoLT faced by immigrant learners, some local learners avoided, stereotyped and labelled AILs as the least desirable group to work with when doing MWPs. These findings about AILs being stigmatised, stereotyped, labelled, and isolated from the local learners in MWPs classes, corroborated the findings made by Harber and Mncube (2011) that far from providing learners with equal education opportunities, some schools were places of bigotry and discrimination. Generally, AILs had little sense of belonging in the mathematics classroom; which negatively affected their understanding and performance in the learning of MWPs.

5.21. Conclusion

In this chapter the findings were presented, discussed, and analysed. The data collection from classroom observations and semi-structured interviews were discussed to find the meaning of the lived experiences of AILs learning MWPs. It was found that AILs experienced negatively the use of code switching, isolation, marginalisation, invisibility and interactions between participants, as well as teacher incompetence and lack of training in teaching of immigrant learners. Learners were taught by unqualified and sometimes uncaring teachers and they faced challenges in understanding mathematical language that is embedded in solving MWPs. Chapter six provides the summary of the findings of chapters four and five as well as presenting the Integrated Transitional Intervention (ITI) conceptual framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving.

CHAPTER 6
A CONCEPTUAL FRAMEWORK FOR INTEGRATED TRANSITION INTERVENTION (ITI)

6.1. Introduction

Findings from chapters four and five show that teachers need to be considerate and sensitive in the way they teach, relate to, and incorporate immigrant learners, so that these learners may have a smooth transition from their previous education system to the new one. This chapter begins by summarising the main research findings presented and discussed in chapters four and five. The overall research aim of this chapter is to develop a framework to assist these learners, and teachers, in order to answer the research question: *How can a researcher develop a framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?* The chapter will therefore move on to present and discuss the conceptual framework which was developed from the findings of this research.

6.2. Summary of previous chapters

Chapter one comprised an introduction to the study, the research statement, background of the research problem, purpose of the study and its significance, as well as the research questions. Chapter two discussed phenomenological philosophy as the underpinning theoretical framework of this study. The literature review highlighted previous studies about immigrant learners, lived experiences as well as pertinent issues concerning MWPs, LoLT usage in the learning of mathematics, immigrant learners' mathematics performance, teaching and learning approaches, and parental involvement. The relations and interactions of immigrant learners with teachers, co-national and local learners were discussed. The effects of a range of contributing factors relating to immigrant learners' mathematics knowledge, such as cultural belief and parental involvement were reviewed in detail as well as possible strategies to cater for the needs of these learners.

Chapter three discussed and described the interpretive paradigm, bracketing, phenomenological research methodology and design of the investigation. Classroom observations and semi-structured interviews were used as methods for collecting data that allowed for explication. Analysed data were collected through semi-structured interviews and classroom observations. Triangulation, validity, dependability, and trustworthiness were ensured by the use of various research methods and the range of participants. Chapter four dealt with the analysis of the impact of LoLT on the teaching and learning of participating learners, mathematics language,

MWPs, prior knowledge as well as the curricular transition. In chapter five there was an extended discussion of the findings of the study. Certain issues emerged such as isolation, use of technological resources, use of CS, and teacher experiences in teaching immigrant learners. Interactions between teachers and AILs, and between local learners and AILs, were dealt with. Certain key issues arose from this research project such as the invisibility and discrimination against AILs in the learning and teaching of MWPs.

6.3. Discussion of main research findings: A summary

This section relates, analyses and considers those findings concerning the lived learning experiences of AILs in learning MWPs by reconstructing participants' inner consciousness in order to gain a deeper understanding of, and intuition into their lived worlds (Van Manen, 1997). By forming a written representation of the experiences of participants in mathematics classes, it was found that teaching in classes that included AILs presented a challenge to teachers and to schools.

6.3.1. Discrimination, stigmatisation and labelling

In mathematics classes, high levels of segregation, discrimination, labelling, name-calling, and stigmatisation of foreign learners were observed: local learners and teachers sometimes openly mocked these learners' limited LoLT proficiency, different cultures and foreign accents. Some teachers were blind to the needs and sensitivities of foreign learners leading to negative effects on these learners' already weak understanding of mathematics word problems in a new language. This derogatory behaviour was evidenced by little or no communication, collaboration, interaction, or sharing of ideas between some teachers, local learners, and immigrant learners

It was noticed that after the intervention programme some of the mathematics teachers were observed to include most learners more fully in their teaching and learning process. The immigrant learners expressed that there were certain teachers who had negative attitudes towards them: they segregated and isolated immigrant learners during the teaching and learning process.

6.3.2. Mathematics language and LoLT.

It was found in this study that the majority of immigrant learners had language acquisition needs at the beginning of the study but that they improved after the intervention programmes. Participating learners had limited LoLT proficiency which affected their understanding of

MWPs since they were unable to engage with the mathematics language in the current curriculum. Some learners were unable to read and to explain the meanings of some of the MWPs presented by their teachers; despite their teachers having earlier explained some of the mathematical terms to them. It was observed that many foreign learners appeared to be highly motivated by their predicament to apply themselves to their studies and were keen to learn under challenging situations. Some mathematics teachers were aware of the learning experiences of AILs in their classes and developed strategies to cater for these learners' limited proficiency in LoLT.

6.3.3. Teacher-learner interactions

At the beginning of the study, little interaction was observed between local and immigrant learners or between immigrant learners and teachers. There was little inclusivity or building of multicultural relations during learning and teaching of MWPs, which was consistent with the "education for all" goal of the DoE. The intervention programme at both schools promoted a welcoming and conducive learning environment because the programme helped teachers to become aware of the needs of diverse learners; especially those of African immigrants.

South African teachers who recommended that AILs should be isolated and learn separately from local learners, often fail to recognise how much these learners have to offer to the South African education system. This marginalised group can add diversity and unique funds of knowledge to the South African education system. There is need for teachers to teach learners inclusively; regardless of the heterogeneity of academic skills, language, race, culture, or citizenship (Equal Education Law Centre (EELC), 2016; DoE, 2005). It was evident from this study that South African teachers often operated in an ever-changing environment with diverse learners coming into the education system from beyond South African borders, especially from other African countries. It was apparent that the learning relations between local and immigrant learners, and teachers and immigrant learners needed to improve. Thus, good teacher-learner interactions would promote better reasoning, leading to academic achievement and engaging immigrant learners in their transition into the new learning environment.

6.3.4. Immigrant learners' funds of knowledge and code switching

The voices of AILs heard in this study should alert authorities in South African education to attend to the needs and challenges of this neglected group of learners. Husserl (1970) noted that it is essential to determine the truth of people's lived experiences by rigorous investigation. It was ascertained from this research project that learners' prior knowledge frequently comprised

an essential learning resource which should be considered a benefit and not an obstacle to the learning process. African immigrant learners' prior knowledge constituted a learning resource in that it helped them to understand new mathematical concepts, if given the chance to do so. Hewitt-Bradshaw (2013:1194) noted that, "language is closely tied to the culture of learners and influences their world-views". It was observed that CS provided a learning resource for learners to understand and link previous and current mathematics knowledge. Allowing immigrant learners to express themselves in their home languages with peers and co-national teachers assisted these learners to comprehend MWPs. Co-national mathematics teachers knew immigrant learners' home languages, which promoted pedagogical interactions. Some immigrant learners assisted newly arrived immigrants by using CS to translate mathematical concepts. Code switching and learners' own unique funds of knowledge were used as prior learning resources for assisting immigrant learners to understand mathematics concepts. Swain and Cummins (1979) argued that the positive effects of multiple languages depend on the similarities of the languages of the teacher, learners and LoLT. Teachers can use multilingualism as a learning resource in their teaching and learning strategies, adopting holistic and integrated teaching approaches that cater for all learners. Teachers can gainfully incorporate immigrant learners' real-life knowledge so that these learners can better understand MWPs while learners can contribute knowledge from their communities, which is beneficial to the entire mathematics class or school.

6.3.5. Teacher professionalism

Some participating learners were allocated to classes led by unqualified and less experienced teachers who were ignorant of their needs. Due to a shortage of suitably qualified mathematics teachers, some without any mathematical background were appointed to teach mathematics (**Appendix G)**. It was observed that inexperienced teachers and low performing schools were some of the challenges faced by immigrant learners. Interviews corroborated the classroom observations that some of the mathematics teachers were inexperienced and faced problems in the use of LoLT to teach MWPs. Some learners were unable to read and to explain the meanings of some of the MWPs posed by their teachers; despite their teachers having explained the mathematics terminology to them. It appears that most South African teachers are ill-equipped to teach foreign learners. Most participating teachers in this study had not been formally trained or even informed about the rudiments of teaching AILs. The dramatic increase in the number of foreign learners in SA demands teacher development in LoLT and mathematics content. With limited teaching and learning resources, support and a wide range of English-language skills, mathematical skills and educational backgrounds, teachers of immigrant learners in SA

seldom offer individualized educational opportunities for their increasingly large and diverse numbers of immigrant learners (APA, 2012). The findings of this study demonstrated that AILs were often operating in a dynamic learning environment with linguistic and cultural attributes quite different from their own. Van Manen (1997:38) noted that:

> *As we research the possible meaning structures of our lived experience, we come to a fuller grasp of what it means to be in the world as a man, a woman, a child, taking into account the sociocultural and the historical traditions which have given meaning to our ways of being in the world.*

During classroom observations, I observed that, although some teachers tried their best to explain the meaning of new mathematical terms, they sometimes overlooked or skipped important mathematical terms. It was found that more than half of the participating teachers in this study confessed that they were uncomfortable with MWPs because they were not appropriately trained and were inexperienced in teaching mathematics. There was evidently a need for further professional development or continuous professional development for teachers to keep abreast with latest information on the education systems of their learners, so as to be inclusive and support learners in their transition to their current learning situations. Teachers should be life-long learners; as indicated by the *Norms and Standard for Educators* (DoE, 2000). There should be more or bilingual teachers (co-nationals) to help diverse learners, especially immigrants. It was found in this study that teaching assisted by co-nationals who can code switch with AILs helped learners to understand mathematical word problems. Co-national teacher assistants promoted learners' mathematical understanding and gave them confidence; instead of becoming confused and left out through lack of linguistic assistance from their new teachers. Candy (2009) argued that schools should try to provide teacher training support to cater for diverse learners. In his study of AILs, Hemson (2011) found instances where schoolteachers worked with charities that provided classes for refugees so that these teachers could gain experience and exposure in assisting immigrant learners.

6.3.6. Use of technology in learning of mathematics word problems

It was found that some teachers were using technology to capture the attention of a new generation of learners. The use of technology created a learning environment that promoted greater collaboration, enhanced communication, coordination, and encouraged all learners to understand their role in bringing about meaningful change in the education system; by promoting 21st century skills. Use of computers was seen as a valuable teaching method that excited and promoted high learner concentration, collaboration, communication, critical

thinking, and confidence in learning of mathematics. Most learners experienced their "first time" use of computers which made them confident and independent in learning MWPs. During my classroom observations in the ICT laboratory, I discerned evidence of excitement, happiness, seriousness, silence, and a positive learning atmosphere because all learners were busy using computers to manipulate their mathematical tasks individually. The use of visuals and hands-on or real-life activities allowed learners to understand new concepts. By relating teaching and learning material to learners' lived experiences, for instance through the use of visuals, pictures, maps, personal experiences (real-life knowledge) that were familiar to learners; great improvements were noted in immigrant learners' understanding of MWPs.

The sections above presented a brief summary of the main findings of the research as a background to the framework presented and discussed in the following section.

6.4. Integrated Transition Intervention (ITI): A Conceptual Framework

This section introduces a conceptual framework for an Integrated Transition Intervention (ITI) derived from my research findings, to assist AILs and their teachers involved in learning and teaching of MWPs. This framework was developed after the analysis of the results as there was a need to intervene the experiences of AILs. This ITI conceptual framework answers the research question: *How can a researcher develop a framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?* It fills a significant gap in the current body of knowledge, providing information and insights for teachers of immigrant learners and much-needed information and structured programmes for both learners and teachers. The framework guides teachers' thinking, demonstrating practical interventions, how these interconnect and how interventions can inform and provide best practices for teachers of AILs when facilitating problem-solving. The ITI conceptual framework is of value to teachers of diverse learners including immigrants; it improves learners' understanding of MWPs and facilitates a smooth transition of AILs into the South African school system.

This ITI conceptual framework enables current and future teachers who find themselves in a position of uncertainty, to be more effective in addressing the needs of immigrant learners from elsewhere on the African continent. The application of the framework would protect this group of learners from neglect, exposure to traumatic situations or the antagonism of teachers who are ill-trained to deal with a multi-cultural environment. The framework allows for equal opportunities and attention in accordance with the mandates of the Department of Education

(DoE, 2015). The following **figure 6.1** below depicts this ITI conceptual framework and how the components are linked to achieve better learner performance. The ITI components are essential for positive learner experiences that result in better learner achievement and a smooth transition between education systems.

6.4.1. INTEGRATED TRANSITIONAL INTERVENTION (ITI) CONCEPTUAL FRAMEWORK

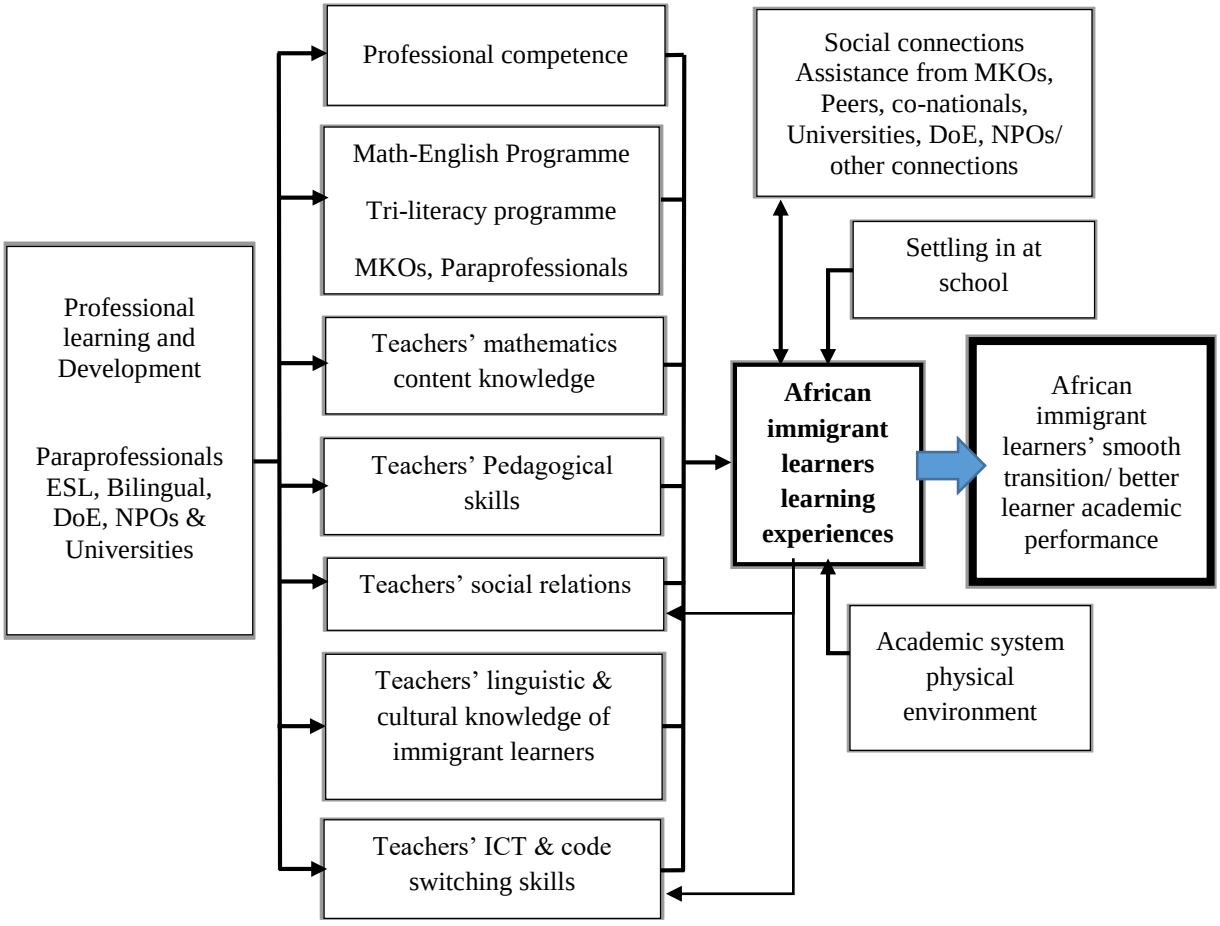

Figure 6.1 The Integrated Transitional Intervention (ITI) conceptual framework

The components of the ITI conceptual framework are discussed below.

6.5. Teacher professional learning and development

Teachers are major components in teaching. If they are not well prepared, there will be challenges for both learners and the teachers themselves (OECD, 2005; Luckenbill, 2018). Providing relevant and effective professional development increases learner performance as illustrated by the ITI conceptual framework. Teacher professional development is an important component in this framework, scaffolding teachers' pedagogical skills when conveying mathematical content knowledge enables teachers to use appropriate mathematical language,

vocabulary, terms and concepts when teaching immigrant learners from other parts of Africa. Teachers can be assisted by specialised mathematics teachers such as bilingual teachers, ESL teachers, paraprofessionals, and local colleagues with experience of teaching AILs. African immigrant learners are usually placed in mainstream classes where English is the LoLT because schools lack teachers who can speak and teach their home languages (Coady et al., 2013; Planas & Setati-Phakeng, 2014). Teachers of immigrant learners from elsewhere in Africa require continuous professional development in teaching immigrant learners; something which is generally not available in South Africa (Gandara & Driscoll, 2005). This development may be provided through the involvement of universities, the DoE, Non-profit organisations (NPOs) and the MKOs such as teachers of bilingual learners with experience in teaching foreign learners comprise productive resources. A conducive learning environment is created by infusing learners' previous learning experiences and using culturally specific learning experiences. Merging the prior knowledge of learners with new content or tapping into learners' funds of knowledge is invaluable to enable both immigrant learners and teachers to master the LoLT. It is essential to promote professionalism and effective teaching by providing effective teacher training in pedagogical skills development in the learning and teaching process (Coady et al., 2013). Professional development could promote quality social interactions between teachers as they learn from the MKOs with others gaining an understanding of the social world around them (Grunwald & Thiersch, 2009). Encouraging teachers to develop "soft skills" such as care, patience, empathy, flexibility, visibility and inclusivity, encourages learners to feel they belong. Ongoing support of teachers' professional dialogue in creating and maintaining peer networks for sharing experience and insights in teaching immigrant learners, is of great value. Teachers as individuals can learn to construct their own understandings of the world through interaction with the environment and the MKOs (Vygotsky, 1978; Makoe, 2008). Close collaboration with the DoE and universities provides in-service accredited courses for teachers, preparing them for teaching immigrant learners or diverse learners, and developing the pedagogical skills of these teachers (Freire, 1996).

6.5.1. Social relations

The language of learning and teaching and social relations are major challenges for teachers and immigrant learners. It was found that social interaction is an important aspect in the learning environment (Vygotsky, 1978) as it promotes cooperation and collaboration between learners and their teachers. Teachers are encouraged to acknowledge and credit learners' prior knowledge or funds of knowledge as a way of linking new concepts in a sustainable and authentic way. Teachers could attend workshops about teaching diverse learners and inculcate

a sense of caring for these learners so as to develop a sense of belonging as contributing members of a learning and teaching community. When teachers develop pedagogical skills, they could help learners to move more easily from being "outsiders" to being part of a new system (Lave & Wenger, 1991). A change of mind-set is necessary; away from assuming that immigrants are not capable of doing MWPs or understanding the LoLT. Teachers are encouraged to provide all learners with equal learning and teaching opportunities and offer a welcoming teaching and learning environment that promotes better interactions among themselves and all learners as social interaction between individuals is an effective method of skills development (Vygotsky, 1978).

It is important to make immigrant learners feel as valued and as appreciated as local learners are by: (i) involving them in all school activities, (ii) giving them opportunities to interact with others and (iii) providing equal learning and teaching opportunities for all learners (EELC, 2016; Van Manen, 1997). By including *all* learners in a common pedagogic experience, immigrant learners can feel connected and part of the learning community within safe, shared learning spaces. Understanding and trust between teachers and learners serves as a catalyst for learners to learn optimally. Learners' trust in their teachers improves learner confidence; knowing that they are part of a learning community. Immigrants will not feel shy or invisible in their classes (Lave and Wenger, 1991; Van Manen, 1997), as teachers have made immigrant learners visible by promoting classroom interaction (Antony & Walshaw, 2008).

Teachers should avoid labelling, stereotyping, stigmatising, or discriminating against immigrant learners but learn to grant them the same opportunities as local learners (Lee & Opio, 2011; EELC, 2016). Teachers need to recognise that relations or interactions with learners are opportunities for development of self-confidence in doing schoolwork (Van Manen, 1997) by promoting interaction between learners through debate, group work and pair work.

6.5.2. Mathematics-English programme

Since LoLT poses a challenge for both teachers and AILs, Mathematics-English programme could be conducted jointly by mathematics and English language teachers to improve reading for understanding skills in mathematics and English. Such a programme is developed, assuming that immigrant learners be offered an opportunity to have afternoon and weekend classes (1 hour from Monday to Thursday, 1 hour every Saturday) that focus on basic mathematics and English, so that AILs can attain the needed standard of academic mathematics language. The programme may be conducted after school or during weekends in a library or an ICT laboratory

to assist AILs. Language is essential for dealing with abstract concepts (Bruner, 1978). Mathematics and English teachers may convene to design a Mathematics-English Programme. This programme is designed to assist learners in acquiring writing, listening, speaking, and reading skills. In particular the programme aims to assist AILs to attain BICS for communicating and interacting with others using English language as LoLT, and transition from BICS to CALP communication; enabling them to better understand MWPs (Cummins, 1981; Cummins et al., 2005). By using the basic mathematical terms and vocabulary, language learners improve their understanding of MWPs. English language teachers assist mathematics teachers to communicate at the level of AILs from simple to complex mathematics. Working together on this programme, teachers learn from each other and share ideas. Mathematics and English teachers devise teaching methodologies suitable for addressing the particular needs of AILs. Local retired mathematics teachers and MKOs immigrants could be deployed in special classes. Some may voluntarily assist these learners during weekends. The MKOs such as tutors, parents, and former immigrant learners, could assist immigrant learners in regular classes by: (i) providing positive academic role models for immigrant learners and (ii) creating lived social relations with immigrants depending upon their MKOs.

The goals of the programme may be summarised as follows:

- Promote mathematical language development for both teachers and AILs.
- Empower teachers and learners with both English and Mathematics skills.
- Encourage learners to have a reading culture for understanding.

During the programme, teachers could learn how to check the content coverage and cognitive ability or levels of newly arrival learners before they start to learn. Checks would be done of learners' BICS and CALP (Cummins et al., 2012; Coady et al., 2013). Teachers would hold workshops about their responsibilities towards new learners so that they can provide equal education to all learners (EELC, 2016). The requirements of the system are spelt out to learners, considering that they are new to the South African education system. New arrivals are guided about the school ethos and rules.

6.5.3. Collaborative teaching

Collaborative teaching envisages that teachers form collaborative teaching teams from different clusters working together to plan, share resources, skills, and knowledge as a group. When teachers are engaged in peer critique it could result in meaningful collaboration for effective working with a variety of colleagues and learners. Teachers could share their experience,

teaching and learning methodologies, pedagogical philosophies, and learn from each other about how to teach AILs in a successful manner. The collaborative teaching may involve/or consist of the SMT and subject advisors, enabling them to appreciate the challenges teachers face with this unique group of learners in South African schools. Collaboration enables a peer group to gain skills and knowledge and acts as an eye-opener for them as they gain new teaching strategies on how to cater for diverse learners, share ideas, gain confidence to face challenges and exchange mathematical knowledge and skills (Tomlinson & Mc Tighe, 2006). In collaborative teaching, MKOs help the less capable in their zone of proximal development (Vygotsky, 1978). Both new and old teachers gain pedagogical skills, pedagogical content knowledge or mathematical content from experienced teachers of AILs on how to effectively teach AILs in using the LoLT. The group may engage in team teaching (co-teaching) which allows for more social interaction such that learners can develop CALP, resulting in better African immigrant learners' academic performance (Cummins et al., 2012). This conceptual framework assists teachers to share pedagogical skills, teaching and learning styles that are useful when dealing with diverse learners (McLeod, 2019). Teachers should be exposed to new methods of teaching as well as how to share their methods, for example, how to use technology in teaching AILs and how to use learner-centred approaches such as group work activities. A variety of learner-centred methods, especially pair work, group work and use of technological resources, would promote social interaction (Tomlinson & McTighe, 2006). Keeping teachers abreast of rapid changes in the teaching and learning environment helps new teachers to transition, promoting an interactive learning and teaching environment that leads to better learner academic performance.

6.5.4. Cooperative learning

Cooperative learning can be conducted by both experienced and novice teachers, working together after school or during weekends. Mathematics teachers come together to supervise the mixing of learners from different classes of the same grade to collaborate with the assistance of paraprofessionals or specialised teachers of AILs. Only willing local learners work in these classes with immigrant learners. Cooperative teaching allows teachers to teach a small group, which promotes a free and conducive learning environment for learners to learn as a community (Echevarria, Vogt & Short, 2007).

Positive learner involvement is promoted since the teacher can vary teaching methods to cater for inclusivity as reflected in policy documents (DoE, 2015). Cooperative learning promotes self-discovery, creative thinking, innovation, confidence, and independence as it helps less

skilled learners to learn from MKOs (Silver, 2011). Encouraging immigrant learners and local learners to cooperate could help AILs to belong and be accepted by the new learning community (Wenger & Lave, 1991). As immigrant learners work with locals and communicate using mathematics language when solving MWPs they develop their own language competence levels from BICS to CALP (Cummins et al., 2005). Interactions between immigrant learners and MKOs improve the immigrant learners' lived social relations (Van Manen, 2007). Promoting group work improves learner communication, critical thinking and creativity as supported by Echevarria et al. (2007:92) who averred that "Peer interaction supports critical thinking and content learning". Cooperative learning increases learner self-esteem as well as a constructive social interaction (Tomlinson & McTighe, 2006).

6.5.5. Technological resources

Technology provides a rich lived space with resources that allow learners to discover, work independently as well as cooperatively (Van Manen, 2007). Technological resources allow learners to investigate and think critically and creatively. This resource needs to be explicitly acknowledged and exploited to the benefit of all learners. The use of mathematical computer games draws learners' attention as they gain technological skills (computer skills). It could encourage visual learning since learners use technology to visualize mathematical problems represented from words to diagrams. Google Translate provides instant translation between over 100 languages, currently including Hausa, Nyanja, Somali, Arabic, French, Yoruba, and Shona. This App is available on the Android system used on smartphones as well as Windows and iOS systems used on many laptops. Using Google Translate amounts to code-switching by learners. When they type statements in English and translate them into their home languages that is bound to be of great use in helping AILs to understand MWPs that are stated in English (Cummins et al., 2012). Textbooks presented in digital form (e-books) may be used synergistically with Google Translate, offering a new learning environment that is richer in resources. Beyond the school timetable, digital references offer learners an opportunity to learn on their own and have individual and sufficient resources to promote self-introspection and self-evaluation as they gain lived selfhood (Van Manen, 1997).

6.5.6. Code switching

This component named the "Tri-literacy" programme, with the aid of parents and co-nationals, deals with the same tasks as in class. The programme strengthens additive learning (Cummins, 1981). Inviting immigrant parents to explain to learners using methods from their home countries and in their home language, brings hope to AILs used to being taught by their parents

in their own language. This component promotes better understanding since learners benefit from their own funds of knowledge. "Tri-literacy" involves the use of LoLT, CS by both parents and learners; African immigrant learners' funds of knowledge could be fully utilized.

In one application of CS, AILs send questions through WhatsApp or SHAREit to co-nationals MKOs who explain using CS, enabling AILs to understand the word problems. Code switching promotes cooperation among learners who speak the same language (Cummins et al., 2005; Cummins et al., 2012). Code switching assists AILs to be motivated because they are taught by MKOs who speak their home language. The "Tri-literacy" programme creates a conducive learning environment for all learners.

6.6. Conclusion

In this chapter a summary of the findings was presented and discussed. This was followed by a discussion of the ITI conceptual framework that is expected to assist both teachers and learners to learn and teach mathematics word problems effectively. This ITI conceptual framework hopefully fills a significant gap in the current body of knowledge and provides much-needed information and structured programmes for both learners and teachers. Different components of the ITI that could lead to improved performance by learners were discussed to show their linkages. Thus, if we are to educate immigrant learners to their full potential so that they can participate fully as local learners, we have to prepare all teachers to create conducive learning and teaching environments that embrace all learners. Chapter seven presents conclusions and recommendations of the study.

CHAPTER 7
CONCLUSION AND RECOMMENDATIONS

7.1. Introduction

In chapter six, I presented a summary of the findings and discussed the development of the ITI conceptual framework that emanated from the research findings to assist AILs and their teachers involved in learning and teaching of MWPs. The ITI conceptual framework was developed to answer the research question: *How can a researcher develop a framework for integrating immigrant learners into the South African mathematics classroom for the purpose of facilitating problem-solving?* Situated within a phenomenological paradigm, this research explores the lived experiences of participants while learning MWPs in the FET phase in South African schools. In this chapter, I present the conclusion and recommendations to the study.

7.2. Conclusion

This is one of the first studies in SA to grant a voice to AILs; to listen to their lived experiences in the learning of MWPs and mathematics in general. The lived experiences of these learners are unique and can provide rich, new academic knowledge to mathematics education for all. It was found that in SA, the increasing number of AILs presented many challenges: LoLT acquisition, mathematical language, social relations, inclusivity, diversity, equity and fairness in the learning and teaching process. The participating learners' learning experiences were both intercultural and intellectual journeys as learners, both AILs and locals, exchanged ideas, knowledge, and intellectual values through the learning of MWPs.

This study brings greater insight to the need for the DoE to attend to the plight of immigrant learners in the South African education system, as well as challenges faced by both teachers and all learners in South African schools. The findings reveal that teachers, school principals and the DoE had little or no concern in attending to African immigrant learners' challenges; indeed these learners were often invisible, left out, labelled, stigmatised, marginalised, and largely unnoticed by South African teachers in the learning process. The employment of bilingual or co-national teachers to assist immigrant learners led to an improvement in learner performance at schools where less-qualified teachers were teaching mathematics to AILs. The limited teaching skills of some South African teachers and their use of code switching presented a great challenge to participating AILs who were confused in some classes. Code switching by assistant teachers (co-nationals who shared the same home languages) was found, however, to be an important learning resource that enabled learners to understand and link their previous

knowledge with current knowledge. When CS was used in an appropriate manner, it was vital in assisting immigrant learners to acquire both BICS and CALP. When AILs were incorporated into the learning of MWPs, these learners understood MWPs better than before the intervention programme: they appreciated that their languages were essential for their progress and valued in the host country.

The findings reveal that AILs desire a sense of care, belonging and acceptance in their mathematics classes, which their teachers and local learners did not always afford them. It is essential to recognize the worth of immigrant learners for their unique abilities, which are useful to local learners in promoting diversity, collaboration, and success in the learning of MWPs, as well as a pan-African ethos. Yet AILs, who lacked prior mathematics knowledge and had limited LoLT language abilities, faced barriers to accessing quality education in mathematics. The arrival of AILs in South African schools poses additional learning and teaching challenges to South African teachers and to the whole education system. The use of technology in the teaching and learning of MWPs enhanced the learning experiences of AILs by promoting life-affirming, independent learning and learner-centred mathematics instruction.

African immigrant learners, due to their lack of LoLT proficiency, mathematical skills, and their distinctive culture, were frequently discriminated against and isolated by some of the teachers and local learners. This study pointed to an urgent need to improve teacher-learner relations; by creating a collaborative, cooperative, interactive, and conducive teaching and learning environment that promotes diversity and education for all learners, regardless of nationality. Some of the most pertinent findings from the study are that teachers should be considerate and sensitive in the way they teach, relate to and incorporate immigrant learners; so as to facilitate a smooth transition from their previous education system to the new and alien one.

This study concluded by designing the ITI conceptual framework. In doing so the study contributed to the body of knowledge in a way that has potential to assist both teachers and learners to learn and teach MWPs effectively. African immigrant learners face multiple challenges in learning MWPs and need much assistance from all stakeholders in their education. More effort to assist these learners is needed since more immigrant learners are flocking into South African public schools and the South African educational system does not currently take cognisance of the fact that some learners have not experienced English as their LoLT. This is why the ITI conceptual framework was devised and presented to assist teachers and AILs to

develop their LoLT proficiency, so that they build academic mathematics language skills and knowledge in as well as integrating immigrant learners into the South African mathematics classroom in respect of facilitating problem-solving. Once teachers are assisted by means of professional development, they will be better equipped to teach learners optimally, resulting in better learner performance. All interventions and assistance provided to both teachers and AILs promote a better transition of AILs into a new education system.

7.3. Recommendations

From the findings presented in the previous chapters, I present the recommendations below; focusing on the following themes: training and practice, orientation and awareness, policy, research, and collaboration.

7.3.1. Training and practice

Providing pre-service and in-service training of teachers on how to teach diverse learners, equips them to meet the needs of both AILs and local learners. It is recommended that the DoE conduct professional development courses for in-service teachers for them to deepen mathematics content knowledge, pedagogical skills, and social relations skills, ICT and CS skills, linguistic and cultural knowledge of immigrant learners and introduce effective, holistic and integrated teaching and learning methods for diverse learners. This initiative grants young learners in SA their right to a good mathematical education. In-service training provides teachers with life-long learning to keep up to date with mathematical content knowledge, new teaching techniques as well as the changing demands of the world of mathematics and learner diversity. It is recommended that schools should recruit suitably qualified and experienced teachers because so-called township schools, where most AILs are enrolled, tend to attract teachers less committed to improving the standard of mathematics learning. Deployment of qualified mathematics teachers ensures that learners under their supervision receive effective and efficient teaching while promoting the use of academic language during discussion of MWPs.

More assistance in terms of teacher training, teacher-learners relations so that teachers could cope with this diverse group of learners, not least because their numbers are increasing in South African schools. More focus on teacher training is needed to make teachers aware and capable of coping with the challenges of teaching diverse learners. The DoE could employ bilingual, multilingual, or ESL teachers who are trained to teach diverse learners to support immigrant learners' linguistic, mathematical, and cultural differences. The DoE should provide bilingual

teachers and especially co-nationals for AILs or employ co-national assistant teachers to teach AILs, so that these teachers better understand the difficulties of these learners; by applying inclusive learning approaches.

7.3.2. Orientation and awareness about learner diversity

It is recommended that new immigrant arrivals attend English classes offered by ESL teachers so that they can learn at their own pace from English-fluent or native English learners. The public-school system should provide intense English language instruction for bilingual teachers, to integrate immigrant learners into the new educational system by conducting Mathematics-English programmes and promote 'Tri-literacy' programmes. The DoE needs to encourage schools to assess immigrant learners on arrival; to check their English and mathematical skills and knowledge, and to ensure appropriate class placement. The DoE should take the initiative to assist new arrivals of AILs in South African schools by providing more support for immigrant learners when they arrive or provide an additional transition period for designated language support. Teachers should consider immigrant learners to be an integral part of the larger school community; to improve these learners' self-esteem and self-confidence in undertaking MWPs. This inclusion should involve encouraging and promoting positive relations between teachers and AILs, and between AILs and local learners. Teachers, the DoE, and schools should accept and attend to the particular learning challenges and linguistic difficulties of these AILs, recognising that they have much to offer to the South African education system. Teachers need to be reminded about the linguistic and cultural knowledge of immigrant learners in the teaching and learning environment. The DoE should not deny, neglect, or exclude learners because of their nationality or linguistic shortcomings.

It is recommended that (i) mathematics teachers draw upon the funds of knowledge of immigrant learners from other African countries and (ii) that they use CS as a learning resource as well as (iii) permit mixed language groupings and (iv) provide clear explanations of mathematical terms so that all learners understand and be able to speak mathematical language. Teachers should also (i) promote conducive learning and teaching environments that accommodate the unique needs of immigrant learners as well as (ii) avoid discrimination and marginalisation of learners and (iii) promote mathematization during their teaching of mathematics. The DoE and universities are exhorted to work together to allow for and embrace the dramatic changes that are taking place in the education system and classroom population. Thus, the DoE needs to conduct awareness workshops about diversity in schools so that teachers are always equipped in catering for diverse learners in their classrooms.

7.3.3. Policy

South African policy makers should consider and draft policies that enable AILs to acquire an adequate education in South African schools. The DoE should support teachers and learners by engaging them in hearing their lived experiences or world views about the teaching and learning process. The DoE needs to (i) train ESL teachers or certify them to teach (ii) offer classes for AILs with their certified teacher only, (iii) provide continuous monitoring in schools with regard to the teaching and learning process. The South African education system should develop appropriate programmes or models to assist immigrant learners in their educational journey. For example, the Mathematics-English programme and "Tri-literacy" programmes should be promoted in schools. Admission policies should accommodate the needs of all learners in SA, regardless of nationality. Programmes should be arranged for additional support for AILs, such as transition periods for new arrivals to aid these learners in the deployment of co-nationals at school, bilingual teachers, and ESL teachers. All learners in SA should be afforded the opportunity to equal education regardless of their nationality. All learners deserve equal opportunities. All learners inside SA should be included. DoE and stakeholders need to emphasise the significance of monitoring and implementing inclusion, as well as setting out LiEP policies in schools to assist teachers and learners. The DoE should make available policy documents for inclusivity so that teachers may engage and be aware of issues affecting diversity in learning and teaching process. The DoE needs to promote the use of technology such as Google Translate to promote teaching of diverse learners which allows the use of CS as a teaching and learning resource rather than a learning barrier.

7.3.4. Research and collaboration

Universities may include modules on multiculturalism (immigrant learners) programmes in their teacher preparation programs, to allow teachers to hear immigrant learners' voices and be aware of the challenges they will face in the teaching profession. Schools and the DoE may consider partnering with NPOs to assist in language development, continuous professional development in teaching diverse learners. Non Profit Organisations could provide workshops to assist teachers to teach AILs. They could establish English classes as well as employ teachers with the same mother language or bilingual teachers as these learners to promote code switching, resulting in better learning and teaching process. Outsourcing immigrant bilingual teachers who speak the same language as AIL prepares teachers for when they first encounter immigrants in their classes.

Universities could conduct more research into solutions to the challenges faced by teachers, AILs and schools. This research could provide a platform for universities and other stakeholders to observe what is happening in schools so that they can galvanise their training programmes to equip graduates to teach a diversity of learners that includes AILs. Collaboration between teachers, schools, NPOs, the DoE, universities and communities could strengthen relations with locals, parents and schools, enabling graduates to be prepared to teach AILs since the study revealed that some teachers lacked the pedagogical skills needed to teach multicultural instruction. Involving outside stakeholders builds a richer environment with benefits for all stakeholders including AILs and their teachers. These collaborations of stakeholders could promote social connections among South African teachers, immigrant learners and local learners.

REFERENCES

Abebanji, T.O., Phatudi, C.N. &Hartell, C G. 2014. The influence of familial and schooling experiences on the acculturation of immigrant children from Zimbabwe. *Mediterranean Journal of Social Sciences*. 5(20):1039-1050.

Abedi, J.& Lord, C. 2001.The language factor in Mathematics tests. *Applied measurement in Education*, 14(3):219-134.

Adams, J. 2012. What is the lived experience of the learners in a co-teaching classroom? Unpublished PhD thesis, Utah State University, Utah State.

Adams, T.L., Thangata, F.& King, C. 2005. 'Weigh' to go! Exploring mathematical language. *Mathematics Teaching in the Middle School*, 10(9):444-448.

Adelman, H.S. & Taylor, L. 2015. Immigrant children and youth in the USA: Facilitating equity of opportunity at school. *Educ. Sci*. 5:323-344.

Adler, J. 2010. Mathematics for teaching matters. *Education as Change*, 14(2): 123-135.

Afriani, R. 2020. Teacher perception towards the use of code switching in EFL classroom: A case study in English institute program at state Islamic institute in Cirebon, Berumpun. *International Journal of Social, Politics, and Humanities*, 3(1):1-12.

Ajjawi, R. & Higgs, J. 2007. Using hermeneutic phenomenology to investigate how experienced practitioners learn to communicate clinical reasoning. *The Qualitative Report*, 12(4):612-638.

Ajmal, G.M. 2010. Code switching: Awareness about its utility in bilingual classrooms, *Language, culture and curriculum*, 3(2):23-44.

Al-Azami, A. 2008. Bilingual learning for second and third generation children. *Language, culture and curriculum*, 21(2):120-137.

Alenezi, A.A. 2010. Students' language attitude towards using code-switching as a medium of instruction in the college of Health Sciences: An exploratory study. *ARECLS*, 7:1-12

American Psychological Association, Presidential Task Force on Immigration. 2012. *Crossroads: The psychology of immigration in the new century*. Retrieved from http://www.org./immigration/report.aspx

Anderson, D., Cosson, A. &Mclontosh, L. 2015. *Research informing the practice of museum educators*. Canada: Sense Publishers.

Angateeah, K.S.,Hurchand, H.,Sukon, K.S. &Nunkoo-Gonport, P. 2013. "A comparison of the impact of natural language and manipulatives on students' performance on word problems". Athens: ATINER's Conference Paper Series, NO: MAT2013-0815.

Anhalt, C., Farias, L., Farias, S., Olivas, J. & Ulliman, M. 2009. Teaching mathematics to English language learners. *Leadership*, 34-36.

Anthony, G. & Walshaw, M. 2009. Characteristics of effective teaching of Mathematics: A view from the West. *Journal of Mathematics Education*, 2(2):147-164.

Arbour, R.B.& Wiegand, D.L. 2014. Self-described nursing roles experienced during care of dying patients and their families: A phenomenological study. *Intensive and Critical Care Nursing*, 10:1-8.

Aukerman, M. 2007. A culpable CALP: Rethinking the conversational or cognitive academic language proficiency distinction in early literacy instruction. *International Reading Association*, 60:626-635.

Awokoya, J.T. & Clark, C. 2008. Demystifying cultural theories and practices: Locating black immigrant experiences in Teacher Education Research. *Multicultural Education*, 49-58.

Babbie, E. 2011. *Introduction to social research*. Belmont: Washington.

Bacherman, D.M. 2007. The Use of students' First language in second-language learning in a computer based Environment. Unpublished PhD dissertation, Warden University, Minnesota.

Baker, W. 2008. A critical examination of ELT in Thailand. *Regional Language Centre Journal, 39*(1):131-146.

Ball, D. 2008. Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5): 389–407.

Ballantyne, K.G.,Sanderman, A.R. & Levy. J. 2008. *Educating English Language learners: Building teacher capacity*. Washington, DC: Sage.

Barton, B. & Neville-Barton, P. 2005. The relationships between English language and mathematics learning for non-native speakers. *Teaching and Learning Research Initiative*, 1-75.

Barwell, R. 2005. Language in the Mathematics classroom. *Language and Education*, 19(2):117-125.

Barwell, R. 2008. The role of language in mathematics. *National Association for language development in the curriculum*, 1-6.

Barwell, R. 2011.Word problems. Connecting language, mathematics and life. *Research monograph*, 34:1-4

Barwell, R. 2018. From language as a resource to sources of meaning in multilingual mathematics classrooms. *Journal of Mathematical Behaviour,* (50):155-168.

Basit, N.T. 2010. *Conducting research in educational contexts*. London: Continuum International Publishing group.

Basson, P. & Mawson, P. 2011. The experience of violence by male juvenile offenders convicted of assault: A descriptive phenomenological study. *Indo-Pacific Journal of Phenomenology,* 11(1):1-10.

Bernardo, A.B.I. & Calleja, M.O. 2005. The effects of stating problems in bilingual students' first and second languages on solving mathematics word problems. *The Journal of Genetic Psychology*, 166(1):117-128.

Bicer, A., Capraro, M.M. & Capraro, R.M. 2012. The Effects of parent's SES and education level on students' mathematics achievement: examining the mediation effects of parental expectations and parental Communication. *The Online Journal of New Horizons in Education*, 3(4):89-97.

Billings, G.L. 1997. It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education*, 28(6):697-708.

Bitsch, V. 2005. Qualitative research: A grounded theory example and evaluation criteria. *Journal of Agribusiness*, 23(1):75-91.

Blom, B.D. & Gabtree, F.B. 2006.The qualitative research interview. *Medical Education,* 40:314-321.

Bloomberg, L.D. & Volpe, M. 2012. *Completing a qualitative dissertation: A rod map from beginning to end.* Thousand Oaks, CA: Sage.

Blumberg, B., Cooper, D.R. & Schindler, P.S. 2011. *Business Research Methods*, McGraw Hill: Berkshire.

Bogdan, R.C. & Bilken, S.K. 2003. *Qualitative research for education: an introduction to theories and methods*. Boston: Allyn& Bacon.

Bonenfant, J.L. 2012. Mis-usage and misrepresentation of basic interpersonal communication and cognitive academic proficiency in teaching English language learners in first and second grades. *Educational Research Journal*, 153-157.

Botes, H. & Mji, A. 2010. Language diversity in the mathematics classroom: does a learner companion make a difference? *South African Journal of Education,* 30(1):1-16.

Boyd, C.O. 2001. *Phenomenology the method*. Sudbury, MA: Jones and Bartlett.

Brand, B.R. & Glasson, G.E. 2014. Crossing cultural boarders into science teaching: Early life experiences, racial and ethnic identities and beliefs about diversity. *Journal of Research in Science Teaching,* 41(2):119-141.

Brayda, C.W. & Boyce, D.T. 2014. So you really want to interview me? Navigating "sensitive" qualitative research interviewing. *International Journal of Qualitative methods,* 13:318-413.

Brekeimans, M., Wubbles, M.T.& Brok, P. 2004. Teacher experience and the teacher-student relationship in the classroom environment. *World Scientific Journal,* 1-20.

Brenner, M.E. 1998. Development of mathematical communication in problem solving groups by language minority students. *Bilingual Research Journal*, 22(2):149-174.

Brittain, C. 2005. De Paisano a Paisano: Mexican immigrant students and their transnational perceptions of U.S schools. The centre of comparative immigration studies. University of California, San Diego. Working Paper 119.

Brodie, K., Zaheera, J. & Modau, S. 2009. Challenges in implementing the new mathematics curriculum in Grade 10: A case study. *African Journal of Research in Mathematics, Science and Technology Education*, Special issue: 19-33.

Brown, J., Miller, J. & Mitchell. J. 2006. Interrupted schooling and the acquisition of literacy: Experiences of Sudanese refugees in Victorian schools. *Australian Journal of Languages and Literacy*, 29(2):150:162.

Bruner, J.S. 1978. The role of dialogue in language acquisition. In A. Sinclair, R., J. Jarvelle, and W. J.M. Levelt (eds.). *The Child's Concept of Language.* New York: Springer-Verlag.

Bryne, D. 2001. Understanding life experiences through a phenomenological approach to research. *AORN Journal*, 23-57.

Burch, R. 1990. Phenomenology, lived experience: Taking a measure of the topic. *Phenomenology Pedagogy*, 8:130-153.

Candy, A.M. 2009. Teaching English language learners: Teacher knowledge, perceptions and behaviour. Unpublished PhD thesis, University of North Carolina Wilmington, North Carolina.

Carrier, K.A. 2005. Key issues for teaching English language learners in academic classrooms. *Middle School Journal*, 37(2):4-9.

Catalano, T., Fox, J. & Vandeyar, S. 2016. Being "in a limbo": Perceptions of immigration, identity and adaptation of immigrant students in South Africa and the United States. *Journal of Language, Identity & Education*, 15(3):137-150.

Cesar, M. &Favilli, F. 2005. *Diversity seen through teachers' eyes: Discourse about multicultural classes*. New York: Sage.

Charles, R. 2015. *Solving word problems. Research into practice*. New York: Pearson.

Choi, J., Lim, J. & An. S. 2011.Marginalized students' uneasy learning: Korean immigrant students' experiences of learning social studies. *Social Studies Research and Practice*, 6(3):1-17.

Chow, H.P. 2004. The effects of ethnic capital and family background on school performance: A case study of Chinese-Canadian adolescents in Calgary. *The Alberta Journal of Educational Research*, 50(3):321-326.

Civil, M. 2008. Mathematics teaching and learning of immigrant students: A look at the key extremes from recent research. ICME II-Survey Teams 5.

Clements, D.H. & Sarama, J. 2009.*Learning and teaching early math: The learning trajectories approach*. New Yolk: Routledge.

Coady, M.R., de Jong, E.J. & Harper, C. 2013. Preparing mainstream teachers for CLD students: Enhancing the knowledge and skills that teachers of CLDs must have. *Theory into Practice*, 52(2):89-97.

Cochran-Smith, M. 2008. The new teacher education in the United States: Directions forward. *Teachers and Teaching*. 14(5):270–292.

Cohen, L., Manion, L. & Morrison, K. 2007. *Research methods in education*. New York: Routledge.

Colaizzi. P. 1978. *Reflections and research in Psychology: A phenomenological study*. Dubuque, IA: Kendall.

Collins, J. & Hussey, R. 2009. *Business Research: A practical guide for undergraduate and post graduate students*. New York: Palgrave Macmillan.

Concise Oxford English dictionary. 10th ed. 2014. New York: OUP.

Connell. B. 2003. A phenomenological study of the lived experiences of adult caregiving daughters and their elderly mothers. Unpublished PhD. University of Florida: Florida.

Conroy, S.A. 2003. A pathway for interpretive phenomenology. *International Journal of Qualitative Methods*, 2(3):1-22.

Constandi, S. 2010. Meandering through my epistemological patchwork quilt: A narrative inquiry of my landscape of learning. *Journal of Philosophy and History of Education*, 60:86-100.

Cozett. D.C. 2015. Determining the efficacy of the home school partnership programme. Unpublished masters thesis. Cape Peninsula University of Technology. Cape Town.

Creswell, J,W. 2009. *Research design: Qualitative, quantitative and mixed methods approaches*. Los Angeles, CA: Sage.

Creswell, J.W. 2013. *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.

Creswell, J.W. 2014. *Research design*. Thousand Oaks: Sage.

Cummins, J.1979. Cognitive/Academic Language Proficiency, Linguistic Interdependence, the Optimum Age Question and Some Other Matters. *Working Papers on Bilingualism*, 19:196-205.

Cummins, J. 1981. Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research,* 49: 222-251.

Cummins, J. 1984. *Bilingualism and Special Education: Issues in Assessment and Pedagogy*. Clevedon: Multilingual Matters.

Cummins, J. 1986. *Bilingualism in education: Aspects of theory research and practice*. London: Longman.

Cummins, J. 2000. *Language, power and pedagogy: Bilingual children in the crossfire*, Clevedon: Multilingual Matters.

Cummins, J. 2001. Negotiating identities: Education for empowerment in a diverse society. *California Association for Bilingual Education,* 1-125.

Cummins, J. 2007. Rethinking monolingual instructional strategies in the multilingual classroom. *Canadian Journal of Applied Linguistic*, 10(2):210-240.

Cummins, J. 2014. Beyond language: Academic communication and student success. *Linguistics and Educational Journal*, 26:145-153.

Cummins, J.,Bismilla, V., Chow, P., Cohen, S.,Giampapa, F., Leon, L., Sandhu, P. &Sastri, P. 2005. Affirming identity in multilingual classrooms. *Educational Leadership,* 63(1):38-43.

Cummins, J.,Mirza, R.& Stille, S. 2012. English language learners in Canadian schools. Emerging directions for school-based policies. *TELS CANADA JOURNAL,* 29(6):25-48.

D'Ambrosio, U. 2001. "What is Ethnomathematics and how can it Help Children in Schools?"

Dantas, M.L. 2007. Building teacher competency to work with diverse learners in the context of international education. *Teacher Education Quarterly Journal,* 75-94.

De Castro, A. 2005. Introduction to Giorgi's existential phenomenological research method. *Indo-Pacific Journal of Phenomenology,* 11:45-56.

De Jong, E.J. & Harper, C.A. 2005. Preparing mainstream teachers for English language learners: Is being a good teacher good enough? *Teacher Education Quarterly*, 101-124.

De Vos, A.S., Strydom, H., Fouche, C.B. & Delport, C.S.L. 2011. *Research at grassroots for social sciences and human services professions* 3rd edition. Pretoria: Van Schaik.

Denzin, N.K. & Lincoln, Y.S. 1998. *Introduction: Entering the field of qualitative research*. Thousand Oaks, CA: Sage.

Derry, S.J. 2007. *Guidelines for video research in education*. New York: Sage.

Descombe, M. 2010. *The good research guide for small scale social research projects.* London: Open University Press.

Deussen, T.,Autio, E., Miller, B., Lockwood, T.A. & Stewart, V. 2008. What teachers should know about instruction for English language learners? *Centre for Research, Evaluation & Assessment,* 1-68.

Devetak, I., Glazar, S.A. &Vogrinc, J. 2010. The role of qualitative research in Science Education. *Eurasia Journal of Mathematics*, 6(1):77-84.

Diaz Andrade, A. 2009. Interpretive research aiming at theory building: Adopting and adapting the case study design. *The Qualitative Report,* 14(1):42-60.

Dicicco-Bloom, B.& Gabtree, B.F. 2006.The qualitative research interview. *Medical Education*. 40:314-321.

Diego, J.D. 2014. The challenges, influences and experiences of Slavic immigrant education in the US. *World Journal of Educational Research*, 1(1):56-65.

Doyle, S.L. 2010. Transitioning a Lutheran elementary school to meet the needs of English language learners and their families: The first two years. Unpublished thesis, Regis University: 1-197.

Durano, F. 2009. Attitudes towards English and Fil-English code switching amongst high school students in Ormoc City, Philippines. Unpublished thesis. Philippines: City University

Echevarria, J., Vogt, L.A.& Short, D.J. 2007. *Making content comprehensible for English learners: The SIOP model* (3rd ed.). Boston, MA: Pearson/Allyn& Bacon.

Edward, K.L. & Welch. T. 2011. The extension of Collaizzi's method of phenomenological enquiry. *Contemporary Nurse*. 39(2):163-171.

Endo, R. 2010. Asian American youth and educational inequities: the case of post-1965 Japanese-Americans in an urban Nebraskan schooling milieu. In R. Saran & R. Diaz (Eds.), Beyond stereotypes – minority children of immigrants in urban schools (pp. 107-124). Rotterdam, Netherlands: Sense Publishers.

Equal Education Law Centre (EELC). 2016. *Inclusive education. Learners with learning barriers.* The right to an equal quality education. Cape Town.

Erikson Institute Early Math Collaborative. 2017. "What Is Early Math?" http://earlymath.erikson.edu/about-early-math-programming-for-teachers-a.

Ernest, P. 1994. *An introduction to research methodology and paradigms*. Exert, Devon: RSU, University of Exeter.

Ernest, P. 1998. *Social Constructivism as a philosophy of Mathematics*. Albany: SUNY Press.

Essien, A.A. 2010. Investigating proficiency in the language of instruction as means of improving mathematical proficiency in a multilingual classroom. *Education as Change*, 14(2):169-185.

Finlay, L. & Molano-Fisher, P. 2008. 'Transforming' self and world: a phenomenological study of a changing life-world following a cochlear implant. *Medicine, Health Care and Philosophy*, 11(3):255-267.

Finlay, L. 2009. Debating phenomenological research methods. *Phenomenology and Practice*, 3(1):6-25.

Fraenkel, R.J. 2012. *How to design and evaluate research in education*. Mc Graw-Hill. New York.

Fredickson, N. & Cline, T. 2009. *Special educational needs, inclusion and diversity*. Maidenhead: Mc Graw-Hill.

Freeman, M. 2009. *Teaching mathematics to English language learners*. California: Palm Springs. http:/www.mathsolutions.com/CMCELL.

Freire, P. 1996. *Pedagogy of the oppressed*. London: Penguin Group.

Gandara, P., Maxwell-Jolly, J & Driscoll, A. 2005. *Listening to teachers of English Language Learners: A case survey of California teachers' challenges experiences, and professional development needs.* Retrieved from http://www.c.ftl.org

Garcia-Coll, C., Akiba, D., Palacios, N., Silver, R., DiMartino, L. & Chin, C. 2002. Parental involvement in children's education: Lessons from three immigrant groups. *Science and Practice*, 2:303-324.

Gildersleeve, R.E. 2011. "Am I going crazy?" A Critical Race Analysis of Doctoral Education. *Equity & Excellence in Education*, 44(1):93-114.

Giorgi, A. 1989. Some theoretical and practical issues regarding phenomenological method. *Saybrook Review*, 7:71-85.

Giorgi, A. 1997. The theory, practice, and evaluation of the phenomenological method as a qualitative research procedure. *Journal of Phenomenological Psychology*, 28:235-260.

Giorgi, A. 1999. The status of Husserlian phenomenology in caring research. *Scandinavian Journal of Caring Sciences*, 14:3-10.

Giorgi, A. 2005.The phenomenological movement and research in human sciences. *Nursing Science Quarterly*, 18(1):75-82.

Gorgorio, N. & de Abreu, G. 2009. Social representation as mediators of practice in mathematics classrooms with immigrant students. *Education studies Mathematics*, 1-16.

Gorgorio, N. & Planas, N. 2001. 'Teaching mathematics in multilingual classrooms'. *Educational Studies in Mathematics*, 47:7-33.

Gorgorio, N., Prat, M. & Santesteban, M. 2007. The multicultural mathematics classroom: Cultural distance, norms and negotiation. *Mathematics and interculturality*, 7-77.

Gray, E. D. 2014. *Doing research in the real world*. Washington DC. Sage.

Groenewald, T. 2004. A phenomenological research design illustrated. *International Journal of Qualitative Methods*, 3(1):1-26.

Grunwald, K. & Thiersch, H. 2009. The concept of the 'Lifeworld Orientation' for Social Work and Social Care, *Journal of Social World Practice*, 23 (2):131-146.

Guba, E. & Lincoln, Y. 1985. *Effective evaluation: Improving the usefulness of evaluation*. San Francisco: Jossy Bass.

Guba, E.G. 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology*, 29(2):75-91.

Gyasi, W.K. 2013. Impact of effective communication on mathematics education in Ghanaian Senior High schools- Teachers' role. *Asian Journal of Humanities and Social Studies*, 1(1):20-27.

Haag, N., Heppt, B., Stanat, P., Kuhl, P. & Pant, H.A. 2013. Second language learners' performance in Mathematics: Disentangling the effects of academic language features. *Learning and Instruction*, 28:24-34.

Halai, A. & Clarkson, P. 2016. *Teaching and learning mathematics in multilingual classrooms. Issues for Policy, Practice and Teacher Education, 27-43.*

Halliday, M.A.K. 1978. *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.

Harber, C. & Mncube. V. 2011. Is schooling good for the development of society: the case of South Africa. *South African Journal of Education*, 31(2):233-245.

Harman, G. 2007. *Heidegger explained from phenomenology to thing*. Chicago: Carus Publishing Company.

Heidegger, M. 1962. *Being and time*. New York: Harper and Row.

Hellison, D. 2003. *Teaching responsibility through physical activity* (2nd). Champaign, IL: Human Kinetics.

Hemson, C. 2011. Fresh grounds: African immigrants in a South African primary school. *Southern African Review of Education*, 17:65-85.

Henning, E., van Rensburg, W. & Smit, B. 2006. *Finding your way in qualitative research*. Pretoria: Van Schaik.

Hewitt-Bradshaw, I.P. 2013. Understanding the language and literacy challenges for students learning Mathematics and Science in a Caribbean Creole Language Context. *Literacy Information and Computer Education Journal (LICET).* 4(3):1193-1199.

Holmes, N.M. 2014. Increasing parent involvement for ESL parents. Unpublished thesis: University of San Francisco, San Francisco.

Holtman, L., Julie, C.,Mbekwa, M.,Mtetwa, D. &Ngcobo, M. 2011. A comparison of preferences for real-life situations that could be used in school mathematics in three SADC countries. *Southern African Review of Education*, 17:120-137.

Hopp, W. 2008. Husserl, phenomenology and foundationalism. *Inquiry,* 51(2):194-216

http://siteresources.worldbank.org/EDN/Resources?Education-Notes/EdNotes_lang_of_instruct.pdf

http://www.org./immigration/report.aspx

http://www.ped.gu.se/biorn/phgraph/misc/constr/giorgi.html.

http://www.qualitative-research.net/fgs

Husserl, E. 1962. *The idea of phenomenology*. The Hague: Martins Nijhoff.

Husserl, E. 1970. *The crisis of the European Sciences and transcendental phenomenology: An introduction to phenomenological philosophy*. (D. Carr, Trans). Evanston, IL:North-Western University Press.

Hycner, R.H. 1985. Some guidelines for the phenomenological analysis of interview data. *Human Studies,* 8:279-303.

Ibrahim, J. 2001. The implementation of English Medium Instruction (EMI) in Indonesian Universities: its opportunities, its threats, its problems and its possible solutions. I*nternational Journal of Learning,* 3(2):121-138.

Irujo, S. 2007. Teaching mathematics to English Language Learners. *Journal of Curriculum and Supervision,* 8:306-333.

Jan, S. & Rodrigues, S. 2012. Students' difficulties in comprehending mathematical word problems in English language learning contexts. *International Research,* 1(3):152-158.

Janzen, J. 2008. Teaching English Language Learners in the context areas. *Review of Educational Research,* 78(4):1010-1038.

Jegede, O.O. 2012. Roles of code switching in multilingual public primary schools in Ile-Ife, Nigeria. *American Journal of Linguistics,* 1(3):40-46.

Jhagroo, J.R. 2011. A hermeneutic phenomenological study of the lived experiences of immigrant students in their mathematics classrooms at a secondary school in Auckland, New Zealand. Unpublished PhD. Auckland University of Technology. Auckland.

Ji Yeong, I., Chang, H. & Son, J. 2019. *Rethinking the Teaching Mathematics for Emergent Bilinguals: Korean Teacher Perspectives and Practices in Culture, Language, and Mathematics-Mathematics Education-An Asian Perspective*. Singapore: Springer.

Johnson, D.W., Johnson, R.T. & Roseth, C.J. 2010. The impact of constructive controversy on moral development. *Journal of Applied Social Psychology,* 40(4):765-787.

Joubish, M.F. 2011. Paradigms and characteristics of a good qualitative research world. *Applied Science Journal,* 2(11):2082-2087.

Juggernath, A. &Govender, N. 2020. Natural Sciences Teachers' Beliefs as Barriers for Integrating ICTs in a Technology-rich Context. *African Journal of Research in Mathematics, Science and Technology Education,* 24(1):105-115.

Kareva, V. & Echevarria, J. 2013. Using the SIOP Model for Effective Content. Teaching with Second and Foreign Language Learners. *Journal of Education and Training Studies,* 1, 1-10. Retrieved from http://jets.redfame.com.

Kakkari, L. 2009. Hermeneutics and phenomenology problems when applying hermeneutic phenomenological method in educational qualitative research. *Paideusis,* 18(2):19-27.

Kent, M.M. 2007. Immigration and America's black population. *Population bulletin (A publication of the population reference bureau),* 62(4):1-20.

Kessler, C., Quinn, M.E. & Hayes, C.W. 1998. "Processing Mathematics in a Second Language: Problems for LEP Children." Newark, DC: Paper presented at the Delaware Symposium VII on Language Studies. ERIC Document Reproduction Service No. ED 268821.

Kim, S. & Kim, L.R. 2012. The Need for Multicultural Education in South Korea. In D. Urias (Ed.), *The Immigration & Education Nexus, (Vol. 12, pp.243-25).* Sense Publishers.

Kirova, A. 2001. Loneliness in immigrant children: Implications for classroom practice. *Childhood Education*, 77:260–267.

Klotz, A. 2013. *Migration and National Identity in South Africa*. Cambridge: Cambridge University.

Koeller, K. &Jacobs, J. 2015. Distinguishing models of professional development: the case of an adaptive model's impact on teachers. *Journal of Teacher Education,* 66(1):51-67.

Koopman, O. 2015. Phenomenology as a potential methodology for subjective knowing in Science education research. *Indo-Pacific Journal of Phenomenology*, 15(1):1-10.

Koopman, O. 2017. *Science Education and Curriculum in South Africa*. Switzerland: Springer Science and Business Media.

Kornhaber, R., Wilson, A., Abu-Qamar, M.Z. & McLean, L. 2014.Coming to terms with it all: Adult burn survivors' 'lived experience' of acknowledgement and acceptance during rehabilitation. *Burns*, 40:589-597.

Kothari, C.R. 2004. *Research methodology: Methods and techniques*. New Delhi: New Age International private limited publishers.

Kotsopoulos, D. 2007. Mathematics discourse: "It's like hearing a foreign language". *Mathematics Teacher*, 101(4):301-305.

Kruger, D. 1988. *An introduction to phenomenological psychology* (2nd ed.). Cape Town, South Africa: Juta.

Langdridge, D. 2007. *Phenomenological Psychology: Theory, research and methods*. London: Pearson.

Larkin, M., Eatough, V. & Osborn, M. 2011. Interpretive phenomenological analysis and embodied, active, situated cognition. *Theory and Psychology*, 21(3):318-337.

Latu, F.V. 2005. Language factors that affect Mathematics teaching of Pasifika students. *Pythagoras*, 483-490. http://www.merga.net.all/documents/RP532005.pdf.

Lavadenz, M. 2011. From theory to practice for teachers of English learners. *The SOL Journal*, 22(1):18-47.

Lave, J. & Wenger, E. 1991. *Situated learning: Legitimate peripheral participation*. England: Cambridge University Press.

Lazarus, S., & Lomofsky, L. 2010. South Africa: First steps in the development of an inclusive education system. *Cambridge Journal of Education*, 31(3):303-317.

Lee, J. & Opio, T. 2011.Coming to America: Challenges and difficulties faced by African student athletes. *Sports, Education and Society*, 16(5):629-644.

Lee, T., Landy, C.K., Wahoush, O., Khanlou, N., Liu, Y. & Li, C. 2014. A descriptive study of newcomers' experience of maternity care services: Chinese women's perspectives. *BMC Health Services Research,* 14:114-122.

Lerman, S. 2014. Encyclopedia of Mathematics Education. New York: Springer Science and Business Media.

Lester, S. 1999. *An introduction to phenomenological research*. Taunton: London.

Lindsay, M. 2016. *The* philosophical underpinning of Educational research. *Polyglassia*, (19):5-11.

Lindset, A. & Norberg, A. 2004. A phenomenological hermeneutical method for researching lived experience. *Scand J Caring Sci*, 18:145-153.

Lopez, K. & Willis, D. 2004 Descriptive versus interpretive phenomenology: Their contributions to nursing knowledge. *Qualitative Health Research,* 14(5):726-734.

Lucas, T.& Villegas, A.M. 2013. Linguistically Responsive Teacher Education: Preparing Classroom Teachers to Teach English Language Learners. *Journal of TeacherEducation.* 59(4):361-373.

Luckenbill, J. 2018. Mathematizing with toddlers and coaching undergraduates: Foundations for intentional math development. *Young children*. 73(3):1-6.

Luitel, B.C. 2013. A multi-paradigmatic approach to researching lived experiences in mathematics education: Contemplating possible connections. In R. L. Mayes, L. H. Hatfield

Mahofa, E., Adendorff, S. & Kwenda, C. 2018. Exploring the learning of Mathematics word problems by African immigrant early learners. *African Journal of Research in Mathematics, Science and Technology Education,* 22, (1):27-36.

Makoe, M. 2008. Using phenomenological psychology to analyse distance education students' experiences and conceptions of learning. *Indo-Pacific Journal of Phenomenology*, 8:1-11.

Marais, C., van der Westhuizen, G., & Tillema, H. 2013. Teacher knowledge of learners'helping-seeking in Mathematics problem solving. *African Journal of Research in Mathematics, Science and Technology Education,* 17(1-2):63-73

Marilyn, K.S. 2011. *Qualitative research*. London: Sage.

Marji, F. 2009. *Supporting English language learners in math class.* California: Palm Springs.

Martiniello, M. 2008. Language and performance of English-language learners in Mathematics word problems.*Harvard Educational review*.2:333-368.

Marzano, R.J. 2004. *Building background knowledge for academic achievement*. New York: ASCD.

McKinney, C.& Norton, B. 2008. Identity in Language and Literacy Education. In B. Spolsk& F. Hult (eds), *The handbook of educational linguistics*. Malden: Blackwell, (pp. 192-205).

McLeod, S.A. 2019. Bruner, Simply psychology:https://www.simplypsychology.org/bruner.html

Meiers, M. 2010. Language in mathematics classroom. *The Digest*, 2:1-16.

Melville, W., Hardy, I. & Bartley, A. 2011. Bourdieu, department chairs and the reform of science education. *International Journal of Science Education*, 33(16):2275-2293.

Menken, K. 2013. Emergent bilingual students in secondary school: Along the academic language and literacy continuum. *Language Teaching*, 46:438-476.

Merleau-Ponty, M. 1962. *Phenomenology of perception* [Trans. C. Smith]. London: Routledge and Kegan Paul.

Merriam, S. 2015. *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mirici, I,H.,Galleano, R. & Torres, K. 2013. Immigrant parent vs. Immigrant children: Attitudes towards language learning in US. *Research on youth and language*, 7(2):137-146.

Mohamed, L. & Waheed, H. 2011. Secondary students' attitude towards Mathematics in a selected school of Maldives. *International Journal of Humanities and Social Science*, 1(15):277-281.

Moran, D. 2000. Introduction to phenomenology. London: Routledge.

Moreira, D. 2009. Portuguese immigrant children and Mathematics education. *European Research in Mathematics Education*, 1- 44.

Morgan, D.L. 2007. Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1):48-76.

Morse, A. 2005. A look at immigrant youth: Prospects and Promising Practices, National Conference of State Legislatures. Washington DC: USA.

Morton, K. &Qu, Y. 2013. A novel framework for math word problem solving. International *Journal of Information and Education Technology*, 3(1):88-93.

Moschkovich, J. 1998. Resources for refining Mathematics conceptions: Case studies in learning about linear functions. *Journal of the learning Sciences*, 7(2):209-237.

Moschkovich, J. 2005. Using two languages when learning mathematics. *Educational studies in Mathematics*, 64:121-144.

Moschkovich, J. 2007. Bilingual mathematics learner: How views of language, bilingual learners and mathematical communication impact instruction. *Diversity, equity, and access to mathematical ideas*, 89-104.

Moustakas, C. 1994. *Phenomenological research methods.* Thousand Oaks: Sage.

Munzenmaier, C. & Rubin, N. 2013. Perspectives Blooms taxonomy: What's old is new again. Santa Rosa, The eLearning Guild. www.elearningguild.com

Myburgh, O., Poggenpoel, M. & Van Rensburg, W. 2004. Learners' experiences of teaching and learning in a second or third language. *Education,* 124(3):573-585.

Myers, M.D. & Avison, D. 2002. *Qualitative research in information systems*. London: Sage Publications.

National Council of Teachers of Mathematics. 2009. *Principles and Standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Navehebrahim, M. & Jamshidi, A. 2013. Learners use code switching in the English as a foreign language classroom. *Australian Journal of Basic and Applied Sciences,* 7 (1):186-190.

Nelson, T. 2002. *Mathematics Education: A summary of research, theories and practice*. London: Sage.

Neuman, W.L. 2011. *Social research methods: Qualitative and Quantitative approaches*.

Ni Riordain, M. & O' Donoghue, J. 2009. The relationship between performance on mathematical word problems and language proficiency for students' learning through the medium of Irish. *Educational Studies Mathematics,* 71(1):43-64.

Ni Riordain, M. 2011. Tackling the transition-the English mathematics register and students learning through the medium of Irish. *Mathematics Education Research Journal,* 30(3):289-304.

Ni Riordain, M., Cohen, D. & Miller-Reilly, M. 2015. What do we know about mathematics teaching and learning of multilingual adults and why does it matter? *Adults learning Mathematics: An International Journal,* 10(1):8-23.

Nkambule, T., Setati, M. & Duma, B. 2013. *One mathematics classroom, multiple languages*. Proceedings of the 34th annual conference of the International Group for the Psychology of Mathematics Education, Belo Horizonte Brazil.

OECD. 2005. *Teachers Matter: Attracting, Developing, and Retaining Effective Teachers*. Paris: OECD Publishing.

Ogle, D. 1986. K-W-L-A Teaching Model That Develops Active Reading of Expository Text. *The Reading Teacher,* 39:564-570.

Ontario Ministry of Education. 2011.Getting started with student inquiry. Capacity Building Series, Literacy and Numeracy Secretariat Special Edition #22. Retrieved from http://www.edu.gov.ca/eng/literacynumeracy/inspires/research/CBS_StudentInquiry.pdf.

Orey, D.C. 2002.*Ethnomathematics as Pedagogical Action*. California: Lexington.

Pacaya, M. 2005. Meaningful mathematics: Teaching map skills. *Australian Primary Mathematics Classroom,* 12(3):30-32.

Pascal, J., Johnson, N., Dore, C. & Trainer, R. 2011. The lived experience of doing phenomenology: Perspectives from beginning health science postgraduate researchers. *Qualitative Social Work,* 10(2):172-189.

Patton, M. 2002. *Qualitative research and evaluation methods (3rdeds,).* Thousand Oaks CA: Sage.

Paul J.R, Gregory, W. Smith, Elizabeth M.H.& Karen M.F. 2015. The Language of Mathematics: The Importance of Teaching and Learning Mathematical Vocabulary. *Reading & Writing Quarterly*, 31(3): 235-252.

Penner, J.L. & McClement, S.E. 2008.Using phenomenology to examine the experiences of family caregivers of patients with advanced head and neck cancer. *International Journal of Qualitative Methods*, 7(2):92-101.

Perez, W. 2011. *Undocumented Latino students and the promise of higher education*. New York, NY: Teacher College Press.

Perkins, I. & Flores, A. 2002. Mathematics notations and procedures of recent immigrant students. *Mathematics Teaching in the Middle School,* 346-351.

Pettit, S.K. 2011. Teachers' beliefs about English language learners in the mainstream classroom: A review of the literature. *International Multilingual Research Journal*, 5:123–147.

Planas, N. & Civil, M. 2008. Voices of non-immigrant students in the multi-ethnic mathematics classroom. *PME*, 4:121-127.

Planas, N. & Setati-Phakeng, M. 2014. On the process of gaining language as a resource in mathematics education. *ZDM,* 46(6):883-893.

Paul, J.R., Gregory, W.S., Elizabeth, M.H.,& Karen, M.F. 2015. The Language of Mathematics: The Importance of Teaching and Learning Mathematical Vocabulary. *Reading & Writing Quarterly*, 31(3):235-252.

Phoshoko, M.M., & Planas, N. 2015. Mathematics Teachers and Their Understanding of Multiplication: A case of Two African Language-speakers in South Africa. *Journal of Communication*, 6(1):10-17.

Powel, S.R., & Nelson, G. 2017. An investigation of the mathematics-vocabulary knowledge of first-grade students. *The Elementary School Journal*, 117(4):664-686.

Putter-Smits, L.G. Taconis, A.R. & Jochems, W.M. 2013. Mapping context-based learning environments: The construction of an instruments. *Learning Environments Research*, 16(3):437-462.

Rajasekar, S. 2006. Research Methodology. *Educational Research Journal*, 1-23.

Ramphele, M. 1999. *Immigration and educational international students at South African universities and Technikons*. Cape Town: Southern African Migration Project.

Reiners, G.M. 2012. Understanding the differences between Husserl's (Descriptive) and Heidegger's (Interpretive) phenomenological research. *Journal of Nursing Care*, 1(5):119-121.

Republic of South Africa. 1996. *The South African Schools Act, 84 of 1996*. Pretoria: Government Printer.

Ritchie, J. & Lewis, J. 2003. *Qualitative research practice. A guide for Social Sciences students and researchers*. London: Sage.

Robson, C. 2011. *Real world research: A resource for users of social research methods in applied settings.* London: John Wiley and Sons.

Rocha, S.M. 2016. Education as mystery: The enchanting hope of desire. *Educational Philosophy and Theory*, 1-17.

Roer-Strier, D. &Strier, R. 2007. *The role of home and school in the socialisation of immigrant children in Israel*: Mahwah, NJ. Lawrence Erlbaum Associates.

Rolfe, G. 2006. Validity, trustworthiness and rigour: Quality and the idea of qualitative research. *International Journal of Qualitative Methods*, 1(2):304-310.

Ron, P. 1999. *Spanish-English language issues in the mathematics classroom*. London: Sage.

Rosales, A.C. 2015. *Mathematizing: An emergent Math curriculum approach for young children*. ST Paul, MN: Red leaf.

Roth, W.D. & Mehta, J.D. 2002. The Rashomon effect: Combining positivist and interpretivism approaches in the analysis of contested events. *Sociological Methods Research*, 31(2):131-173.

Rubin, A. & Babbie, E. 2010. *Essential research methods for social work*. New York: Brooks/Cole Cengage Learning.

Rumberger, R.W. 2011. *Dropping out*. Harvard University Press.

Sajadi, M.,Amiripour, P.&Rostamy-Malkhalieh, M. 2013. The examining Mathematical word Problems Solving Ability under Efficient Representation Aspect. *Mathematics Education Trends and Research*, 1-11.

Salami, L.O. 2008. 'It is still Double Take': Mother Tongue Education and Bilingual classroom Practice in Nigeria. *Journal of language, Identity and Education*, 6(4):1-23.

Salinas, C., Franquiz, M.E. & Reidel, M. 2008. Teaching world geography to late arrival immigrant learners: High-lighting practice and content. *The Social Studies*, 99(1):71-76.

Samson, D. 2010. Enactivism and figural apprehension in the context of pattern generalisation. In Sparrow, L, Kissane, B &Hust, C. shaping the future of mathematics education: Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australasia, 2:501-508

Samuelsson, J. & Granstom, K. 2007. Important prerequisite for students' mathematical achievement. *Journal of Theory and Practice in Education*, 3(2):150-170.

Sanchez, P. 2007. Urban Education immigrant students: How transnationalism shapes their world learning. *The Urban Review*, 39(5):489-517.

Sanders, C. 2003. Application of Colaizzi's method: Interpretation of an Auditable decision trail by a novice researcher. *Contemporary* Nurse, 14:292-302.

Santamaria, L.J. 2009. Culturally responsive differentiated instruction: Narrowing gaps between best pedagogical practices benefiting all learners. *Teachers College Record*, 111(1):214-247.

Schleppegrell, M.J. 2007. The linguistic challenges of mathematics teaching and learning: A research review. *Reading and Writing Quarterly*, 23(2):139-159.

Schwandt, T.A. 2007. *Dictionary of qualitative inquiry*. Thousand Oaks: Sage

Schmidt, W.H., Cogan, L.& Houang, R. 2011. The role of opportunity to learn in teacher preparation: An international context. *Journal of Teacher Education,* 62(2):138-153.

Seah, W.T., Atweh, B., Clarkson, P.C. & Ellernton, N. 2008. Socio-cultural factors in mathematics teaching and learning. In H. Forgasz, A. Barkatsas, A. Bishop, B. Clarke, S. Keast, W.T. Seah & P. Sullivan (Eds.), *Research in Mathematics education in Australasia 2004-2007* (pp.223-254). Rotterdam: Sense Publishers.

Seale, C., Goba, G., Gubrium, J.F. & Silverman, D. 2004. *Qualitative research practice*. London: Sage.

Secada. W.G. 1995. *New directions for equity in mathematics education*. Cambridge: Cambridge University Press.

Sepeng, P. & Madzorera, A. 2014. Sources of difficulty in comprehending and solving mathematical word problems. *International Educational Science,* 6(2):217-225.

Setati, M & Adler, J. 2001. Between languages and discourses: Language practices in primary multilingual mathematics classrooms in South Africa. *Educational Studies in Mathematics,* 43:243-269.

Setati, M. 2008. Access to mathematics versus access the language of power: The struggle in multilingual mathematics classroom. *South African Journal of Education,* 28:103-116.

Sfard, A. 2009. *Thinking as communicating: Human development, the growth of discourses and mathematizing*. New York: Cambridge University Press.

Shosha, G.A. 2012. Employment of Colaizzi's strategy in descriptive phenomenology: A reflection of a researcher. *European Scientific Journal*, 8(27):31-43.

Sharma, J & Lazar, A. M (Eds).2019. *Rethinking 21st Century Diversity in Teacher Preparation, K-12 Education, and School Policy*. London: Springer

Shrestha, R.K. 2011. Learning English as a foreign language in a non-native country and speaking in the UK: lived experience of Nepalese students. Unpublished PhD. thesis, Brunel University. Brunel.

Silverman, D. 2011. *Interpreting qualitative data: A guide to the principles of qualitative research*. London: Sage.

Silver, D. 2011. Using the 'Zone'Help Reach Every Learner. *Kappa Delta Pi Record, 47(sup1),* 28-31.

Siyepu, W.S. & Ralarala, K.M. 2014. Making sense of Mathematical discourse: Implications for success in the learning of differentiation in a University classroom. *Alteration Special Edition,* 12:326-357.

Skemp, R.R. 1978. Relational understanding and instrumental understanding. *The Arithmetic Teacher*, 26(3):9-15

Slavit, D. & Slavit, G, 2007. Teaching Mathematics and English to English Language Learners simultaneously. *Middle School Journal,* 39:1-11.

Smith, J.A., Flower, P. & Larkin, M. 2012. *Interpretive phenomenological analysis*. London: Sage.

Sofo, S.,Nadzo, J.,Asola, E.F. &Ajongbah, K.S. 2013. African immigrant students' experiences in American Physical Education classes. *International Journal of Arts and Commerce*, 2(10):59-70.

Sookra, H.R., Gopal, N. & Maharaj, J.B. 2005. Interrogating inclusionary and exclusionary practices: Learners of war and flight. *Perspectives in Education*, 3(1):1-14.

South Africa. 1996. *Constitution of the Republic of South Africa Act 108.*www.gov.za/documents/constitution/1996/constitution.pdf [22 June 2019].

South Africa. 2000. Norms and standards for educators. Notice 82 of 2000. *Government Gazette*, 415(20844):1-33, February 4.

South Africa. Department of Education. 2005. *Inclusive education. Conceptual and operational guidelines for the implementation of inclusive education: Special schools as resource centers*: Pretoria: Government Printer.

South Africa. 2014. *Manual for Teaching English Across the Curriculum: Every teacher is a language teacher*. Pretoria: Government Printer.

South Africa. 2017. Department of Home Affairs. *White paper on international migration of South Africa.* Pretoria: Government Printer.http://www.dha.gov.za/WhitePaperonInternationalMigration-20170602.pdf

South Africa. Department of Education. 1997. *New Language in Education Policy*. Pretoria: Government Printer.

South Africa. Department of Education. 2003. *National Language Policy Framework*. Pretoria: Government Printer.

South Africa. Department of Basic Education. 2010. *The status of the language of learning and teaching (LoLT) in South African public schools.* Pretoria: Government Printer.

South Africa. Department of Basic Education. 2011. *Curriculum and Assessment Policy Statement.* Pretoria: Government Printer. http://www.education.pwv.gov.za.

South Africa. Department of Basic Education. 2015. *Draft language Policy*. Pretoria: Government Printer

Spiegelberg, H. 1982. *The lived experiences of childhood loneliness: A phenomenological study.* London: Sage.

Sriraman, B.& English, L. 2010.*Theories of Mathematics Education, Advances in Mathematics Education.* Berlin: Springer.

Starks, H. & Trinidad, S. B. 2007. Choose your method: A comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative Health Research*, 17(10):1372-1380.

Steen, L. 1990. *Mathematics for all Americans*. Reston: National Council of Teachers of Mathematics.

Steinbach, M. 2010. Quand je sorsd'accueil: Linguistic integration of immigrant adolescents in Quebec secondary schools. *Language, Culture and Curriculum* 23(2):95–107.

Stones, R.C. & Moss, L. 2013. The lived experience of acquaintance rape: A phenomenological study of two South African women. *International Journal of Advances in Psychology (IJAP),* 2(4):207-216.

Suarez-Orozco, C., Pimentel, A. & Martin, M. 2009.The significance of relationships; Academic engagement and achievement among newcomer immigrant youth. *Teachers college record,* 111(3):712-749.

Suriel, R.L. 2014. The triangulation of the science English and Spanish languages and cultures in the classroom: Challenges for science teachers of English language learners. In multicultural science education: *Preparing teachers for equity and social justice* (pp. 209-229) Springer: Netherlands.

Swain, M. & Cummins, J. 1979. Bilingualism, cognitive functioning and education. *Language Teaching*, 12(1):4–18.

Swan, P. 2018. The impact of vocabulary on numeracy. *APMC*, 23(4):32-39

Taylor, G.W. & Usher, J.M. 2001. Making sense of S & M: A discourse analytic account. *Sexualities,* 4:293-313.

Taylor, P.C.S. & Medina, M.N.D. 2013. Educational research paradigms: From positivism to multi-paradigmatic. *Journal for meaning-centered Education,* 1-17.

Taylor, T. & Doherty, A. 2005. Adolescent sport, creation and physical education: Experiences of recent arrivals to Canada. *Sport Education and Society,* 10(2):211-238.

Teranishi, R. 2004. Yellow and brown: Emerging Asian American language minority populations and residential segregation. *Equality and Excellence in Education*, 373(3):255-263.

Terre Blanche, T.M. & Durrkein, K. 2006. *Research in practice: Applied methods for the Social Sciences*. Cape Town: University of Cape Town Press (Pty) Ltd.

Thanh, N.C. & Thanh, T.T. 2015. The interconnection between interpretivist paradigm and qualitative methods in education. *American Journal of Education Science,* 1(2):24-27.

Thomas, G. 2013. *How to do your research project*. London: Sage.

Thomas, W. & Collier, V. 2012. *Dual language Education for a Transformed World.* Albuquerque, NM: DLNM Puente Press.

Thomasian, J. 2013. Building a Science, Technology, Engineering and Mathematics: Education Agenda. *National Governors Association*, 1-40.

Tomlinson, C.A, &McTighe, J. 2006. *Integrating differentiated instruction and understanding by design*. Virginia: Association for Supervision and Curriculum Development.

Tongco, M.D.C. 2007. Purposive sapling as a tool for informant selection. *A Journal of plants, people and Applied Research*, 147-158.

Traore, R. 2006. Voices of African students in America: “We’re not from the jungle”. *Multicultural Perspectives,* 8(2):29-34.

Traore, R. 2008. Cultural connections: An alternative to conflict resolution. *Multicultural Education,* 10-14.

Van Manen, M. 1990. *Researching lived experience: Human Science for an action sensitive pedagogy*. London: Althouse.

Van Manen, M. 1997. *Researching lived experience: Human science for an action sensitive pedagogy*. Canada: Althouse.

Van Manen, M. 2007. Phenomenology of Practice. *Phenomenology and Practice*, 1(1):11-30.

Vandermause, R.K. & Fleming, S.E. 2011. Philosophical Hermeneutic Interviewing. *International Journal of Qualitative Methods*, 10(4):367-377.

Vandeyar, S. 2010. Educational and socio-cultural experiences of immigrant students in South African schools. *Education Inquiry*. 1(4):347-365.

Vandeyar, S. 2011. Immigrant students' shifting identifications in South African schools. *International Journal of Educational Development*.1-9.

Vandeyar, S. 2013. Youthscapes: the politics of belonging for 'Makwerekwere'youth in South African schools. *Citizenship Studies*, 17(3):447-463.

Vandeyar, S., Vandeyar, T. &Elufisan, K. 2014. Impediments to the successful reconstruction of African immigrant teachers' professional identities in South African schools. *South African Journal of Education*, 34(2):1-20.

Vandeyar, T. & Vandeyar, S. 2012. Re-negotiating identities and reconciling cultural ambiguities: Socio-cultural experiences of Indian immigrant students in South African Schools. *Journal of Social Sciences*, 32(2):155-167.

Viseu, F. 2012. Open-ended talk in promotion of classroom communication in mathematics. *International Electronic Journal of Elementary Education*, 4 (2):287-300.

Vygotsky, L.S. 1962. *Thought and Language*. Cambridge: MIT Press.

Vygotsky, L.S. 1978. *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wahyuni, D. 2012. The research design maze: Understanding paradigms, cases, methods and methodologies. *JAMAR*, 10(1):69-80.

Waller, P.P., & Flood, C.T. 2016. Mathematics as a universal language: transcending cultural lines. *Journal for Multicultural Education*, 10(3):294-306.

Warren, E., Young, J. & de Vries, E. 2007. Australian Indigenous students: the role of oral language and representation in the negotiation of mathematical understanding. Mathematics: Essential Research, Essential Practice, 2:775-784.

Webb, L. & Webb, P. 2008. Introducing discussion into multilingual mathematics classrooms: an issue of code switching. *Pythagoras*, 67:26-32.

Webb, L. 2015. Conflicting perspectives of power, identity, access and language choice in multilingual teachers' voices. In S.J. Cho (ed.) *Selected Regular Lectures from the 12 ICME* (pp. 843-857). Basel, Switzerland: Springer.

Wenger, T. 2000. Communities of Practice and Social Learning systems. *Sage Journals*. 7(2):225-246.

Wenger, T. 2007. *Applied Business Statistics*. Cape Town: Juta& Co. Ltd.

Wilbourne, M.J.,Marinak, A.B. & Strickland, J.M. 2011. Addressing cultural bias. *Mathematics Teaching in the Middle School*, 26(8):460-465.

Williams, C. 2007. Research methods. *Journal of Business and Economics Research*, 5(3):65-72.

Willig. C. 2008. Reflections on the use of a Phenomenological Method. *Qualitative Research in Psychology,* 4(3):209-225.

Wilson, A. 2015. A guide to phenomenological research. *Nursing Standard*, 29(34):38-43.

Wilson, D. 2014. The learning experiences of parents with children requiring physiotherapy intervention. *APCP Journal*, 5(1):19-29.

Word Bank. 2005. In their own language, Education for all. Education notes.

Wright, W. 2010. *Foundations for teaching English Language Learners: Research, theory, policy*. Philadelphia, PA: Caslon.

www.algebra.com

www.mathsolutions.com

Yildiz, M., Yildirim, K., Ates, S., & Rasinski, T. 2012. Perceptions of Turkish parents with children identified as dyslexic about the problems that they and their children experience. *Reading Psychology*, 33(5):399-422.

Yin, R.K. 2009.*Case study research: Design and Methods*. California: Sage.

Yuksel, P. & Yildirim, S. 2015. Theoretical frameworks, methods and procedures for conducting phenomenological studies in educational settings. *Turkish Online Journal of Qualitative Inquiry*, 6(1):1-17.

Yushau, B. 2009. Mathematics and English: Issues among bilingual Arabs in English medium Universities: *International Journal of Mathematics Education in Sciences and technology*, 40(7):915-926.

APPENDICES

Appendix A: Interview schedule for African immigrant learners

1. What are your experiences of learning mathematics word problems as an African immigrant learner in a South African school?
2. What are the challenges you face when learning mathematics word problems? What do you do to overcome these challenges?
3. Describe your relationship with your teacher in the learning of mathematics word problems.
4. Does your teacher assist you when you encounter problems when doing mathematics word problems? If your answer is yes, how does your teacher assist you?
5. How is your relationship with other learners in the learning of mathematics word problems? Please explain in detail.
6. How do you collaborate with your local South African peers?
7. How do you integrate your past experiences into the present experiences in learning mathematics word problems?
8. Is there any information that you would like to share with me about your experiences in learning of mathematics word problems? If so, you may do so freely.

Appendix B: Interview schedule for teachers

1. What have you experienced in terms of teaching African immigrant learners mathematics word problems?
2. What are the challenges you face when teaching African immigrant learners mathematics word problems? What do you do to overcome these challenges?
3. Do African immigrant learners enjoy doing mathematics word problems?
4. Do you have enough time to assist African immigrant learners during learning of mathematics word problems?
5. What extra support do you provide for African immigrant learners out of your teaching time?
6. How do you describe your relationship with African immigrant learners when teaching them mathematics word problems?
7. What do African immigrant learners mean to you and what do you mean to them in the learning and teaching of mathematics word problems?
8. What is it like to be a teacher for African immigrant learners in teaching and learning of mathematics word problems?
9. How do you describe the interaction between African immigrant learners and the local South African learners in your classes when learning mathematics word problems?
10. Do you have any information that you want to share regarding the experiences of African immigrant learners in the learning of mathematics word problems? If so, you may share it freely.

Appendix C: Field Notes

Grade _____

Subject Mathematics

Date _____

Lesson _____

Topic _____

Duration 45 minutes

Textbook _____

Classroom layout

_____

_____

_____

Description of the seating arrangement

_____

_____

_____

Learner-learner interaction

_____

_____

_____

_____

Teacher-learner interaction

_____

_____

_____

Appendix D: Observation schedule

Name _____

Date and time _____

Observer _____

Site _____

Observation of events and behaviours

_____
_____
_____
_____
_____
_____

Are there visual aids, mathematical related vocabulary (terms) in the classroom that may assist learners?

Summary/ Comments

Appendix E: Observation checklist

	Category	YES	NO
1	Concepts explicitly linked to learners' background learning experiences between past learning and new concepts.		
2	Clear explanations of key mathematics vocabulary and terminology.		
3	Are there visual aids, mathematical related vocabulary (terms) in the classroom that may assist learners?		
4	Language appropriate for learners' proficiency level (slower rate, wait time, simple sentence structure for beginners).		
5	Frequent opportunities for interaction, engagement and discussion between teacher and learner and among learners, which encourage cooperation, collaboration promoting elaborated responses about mathematics concepts.		
6	Problem solving steps and mathematization process followed		
7	Ample opportunities for learners to clarify key concepts in LoLT, first, second language or code switching to communicate freely.		
8	Scaffolding techniques consistently used assisting and supporting learners' understanding (e.g. use of co-nationals and bilingual teachers or think-aloud).		
9	A variety of questions or tasks that promote high-order thinking skills.		
10	Variety of teaching methods used by teachers in problem solving.		

Appendix F: Biographical information of African immigrant learners
Biographical information of African immigrant learners

Pseudonyms M/F	**Age in years**	**Date of enrolment**	**Prior Schooling**	**On arrival intensive instruction coverage for LoLT(Y/N)**	**LoLT used in country of origin**
Rana F	18	01/01/2016	Y-Discontinuous	N	French
Janice F	17	01/01/2016	Y-Continuous	N	French
Gurazzy M	17	01/01/2016	Y-Discontinuous	N	French
Simbe F	19	01/01/2016	Y-Continuous	N	Bari
Muthuli M	20	01/01/2016	Y-Discontinuous	N	Lingala
Ema F	20	01/01/2016	Y-Discontinuous	N	Swahili
Abdullah M	22	01/01/2016	Y-Discontinuous	N	Somali & Arabic
Lube M	20	01/01/2016	Y-Discontinuous	N	Bari
Ababa M	17	01/01/2016	Y-Discontinuous	N	Somali
Chinjo M	21	01/01/2016	Y-Discontinuous	N	Zande
Noah M	19	01/01/2016	Y-Continuous	N	Zande
Gumaka F	18	01/01/2016	Y-Discontinuous	N	French
Mubarak M	22	01/01/2016	Y-Discontinuous	N	Bari
Danest F	21	01/01/2016	Y-Continuous	N	Malagasy& French

Appendix G: Biographical information of South African teachers

Pseudonyms	Country of origin	Mother language	LoLT of the school	Teaching experience	Qualifications
Mr. Roca	South Africa	IsiXhosa	English	22 years	DipEd Mathematics
Mr. Maomanii	South Africa	Afrikaans	English	16 year	DipEd Mathematics
Mrs. Ihoe	South Africa	Afrikaans	English	4 years	Bed Mathematics
Mr. Erdan	South Africa	IsiXhosa	English	3 years	Bcom Economics
Mrs. Muchova	South Africa	IsiXhosa	English	5 years	Bed History and Life Orientation
Mrs. Mwesto	South Africa	Afrikaans	English	3 years	Bed Life Sciences& Mathematical Literacy
Mr. Watso	South Africa	IsiXhosa	English	2 years	Bed Mathematical Literacy& IsiXhosa
Ms. Mdamanest	South Africa	Afrikaans	English	4 years	DipEd Science

Appendix H: Letter to DoE for permission to conduct research

21 Draycott Avenue

Condor Park

Eersterivier

7100

16 September 2015

The Director Research

Western Cape Education Department

Golden Acre

Cape Town

Dear Sir/ Madam

RE: PERMISSION TO USE CHRIS HANI ARTS AND CULTURE HIGH SCHOOL FOR RESEARCH.

I hereby wish to apply to be granted permission to use Chris Hani Arts and Culture High School for my D.Ed. (Mathematics Education) research.

The research is based on "experiences of African immigrant learners in the learning of mathematics word problems in a South African school". Eight mathematics teachers and fourteen learners will be used in this research during the period, January 2016 to June 2016. The lessons of the participating teachers will be observed and recorded for transcription and analysis of the experiences of African immigrant learners in learning of mathematics word problems.

I wish to inform you that all lesson recordings will be used for this research purposes and not for any other use.

I hope my request will be considered.

Yours faithfully

E. Mahofa. (211280526)

Appendix I: Request from school principal for conducting research

21 Draycott Avenue

Condor Park

Eersterivier

7100

16 September 2015

The Principal

Chris Hani Arts and Culture School

Cekeca Road

P.O Box 15

Makhaza

Khayelitsha

7784

Dear Sir

RE: REQUEST TO UTLISE MATHEMATICS TEACHERS AND LEARNERS IN THE RESEARCH.

I hereby wish to use your mathematics teachers and learners in my D.Ed. (Mathematics Education) research.

My research is about "experiences of African immigrant learners in the learning of mathematics word problems in South Africa". Eight mathematics teachers and fourteen learners will be used, only two lessons per teacher will be observed and recorded.

I wish to inform you that all lesson recordings will be used for this research purposes and not for any other use.

It will be greatly appreciated if this application can be positively considered.

Yours faithfully

E. Mahofa (084 7566 160)

Appendix J: Consent form for learners

By signing this form I understand and agree that:

My child will participate in a research concerning "experiences of African immigrant learners in the learning of mathematics word problems in a South African school" that will be conducted by Mr E. Mahofa.

My child's interactions in class discussions may be observed and recorded. In addition, my child may be interviewed.

Video recordings of my child's images may be used for educational purposes only (for this research).

My child's name will not appear in any document.

I am free to withdraw my consent for the participation of my child in the research.

Any queries are welcome and can be forwarded to Mr E. Mahofa (084 756 6160)

_____ _____

Child's Name Date

_____ _____

(Parent or Guardian Name) Parent or Guardian Signature.

Appendix K: Consent letter for teachers

21 Draycott Avenue

Condor Park

Eersterivier

7100

16 September 2015

Dear Teacher

This is a friendly request for your permission to participate in a research project about "experiences of African immigrant learners in learning of mathematics word problems at your school". The research is designed and will be conducted by Mr Mahofa, a registered D.Ed. student at CPUT. The focus of the research will be on the experiences of African immigrant learners in the learning of mathematics word problems.

In addition, I am also writing to request your permission to allow me to observe you teaching mathematics word problems, interview and videotape you for educational purposes. You are free to withdraw your consent for participating in the research. Your identity will be kept confidential and pseudonyms will be used.

Please indicate by signing this letter (see below) that you will participate in the research. If you have any queries you can contact me at 084 756 6160.

Sincerely

Mahofa. E (Researcher)

_____ _____

Name of teacher Signature and Date

Appendix L: Research approval letter

Audrey.wyngaard@westerncape.gov.za
tel: +27 021 467 9272
Fax: 0865902282
Private Bag x9114, Cape Town, 8000
wced.wcape.gov.za

REFERENCE: 20150930 – 3813
ENQUIRIES: Dr A T Wyngaard

Mr Ernest Mahofa
21 Draycot Avenue
Condor Park
Eersterivier
7100

Dear Mr Ernest Mahofa

RESEARCH PROPOSAL: AFRICAN IMMIGRANT LEARNERS' EXPERIENCES IN LEARNING MATHEMATICS WORD PROBLEMS IN THE FURTHER EDUCATION AND TRAINING PHASE IN SOUTH AFRICA

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **18 January 2016 till 30 September 2018**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

    The Director: Research Services
    Western Cape Education Department
    Private Bag X9114
    CAPE TOWN
    8000

We wish you success in your research.

Kind regards.
Signed: Dr Audrey T Wyngaard
Directorate: Research
DATE: 15 June 2016

Appendix M: Editor's Letter

Dr Matthew Curr
Cape Peninsula University of Technology
P.O.Box 13881
Mowbray,
Cape Town
7705
South Africa
Phone: 021 797 0316
curr@sybaweb.co.za
30th July 2020

To whom it may concern

This is to certify that I edited and proofread a Doctoral thesis by Ernest Mahofa, titled:

Towards a conceptual framework for integrating African immigrant learners learning mathematics word problems into South African high schools.

Dr. Matthew Curr

Appendix N: Formatting.

Mr CS Dumas
Cape Peninsula University of Technology
P.O.Box 13881
Mowbray,
Cape Town
7705
South Africa
dumasc@cput.ac.za
08th August 2020

To whom it may concern

This is to certify that I have formatted the Doctoral thesis by Ernest Mahofa, titled:

Towards a conceptual framework for integrating African immigrant learners learning mathematics word problems into South African high schools.

MR CS Dumas

Appendix O: Sample of interview responses for participants (Teachers).

Mr. Roca:

- "*One of the African immigrant learners requested that I should excuse her from explaining or presenting in front of the class as she was shy and had problems in speaking English (5/08/2016)".*
- "*At our school, we have Ubuntu (humanness) among teachers and learners, where teachers, care, love, facilitate, guide and assist each other especially those in need (newcomers) (5/08/2016)".*
- *"Janice now sit in front and is not shy and always fluent and confident now than before, she is powerful and talk as well as explain her mathematics thinking or understanding (5/08/2016)". "I asked conational who finished here at our school to assist in using code switching and explaining the mathematic terms in the immigrant learners' home language. Translation assisted me a lot and I could see the happy or smiles on their faces (learners) (24/09/2016.* "*Our school recruited culturally and linguistically diverse learner helpers, tutors and parents (African immigrants) to assist in our classrooms.*
- *These extended members of the classroom community communicated high academic expectations to immigrant learners, potentially resulting in prejudice reduction for everyone involved in the class (5/08/2016)".*
- "*I used group work to assist immigrant learners when I mix them with local learners but, sometimes it does not work as there will be less or no communication taking place between locals and immigrant learners. It's like I am teaching them to communicate and not mathematics (5/08/2016.*
- *"As a teacher, I give learners more time for interaction and allow them to come up with solutions and explanations of their thinking as there is promotion of language development but at times the immigrant learners seem to be reluctant to think (5/08/2016.*
- *"it was easy for me to work with African immigrant learners as they cooperate well. They were disciplined, I loved them. They were doing my work even if they experienced challenges they came and asked for assistance (15/07/2016)".*
- "*I always allow my learners to read aloud and to re-read the word problems as many times as possible so that they may understand the mathematical language in the mathematics word problems and make sense (5/08/2016)".*

- "*I always call these African immigrant learners after school to provide support so that they cannot be left behind (5/08/2016)".*
- *"This is a challenge to me as these learners are not performing well and are reluctant to be helped due to cultural beliefs (5/08/2016).*
- "*What I like about immigrant learners is that they are willing to learn and they try their best they also study on their own and study so hard to succeed*" *(15/07/2016)".*
- *"With the arrival of African immigrant learners they brought positive attitude towards in mathematics learning, hard work, which is assisting my South African learners to emulate and work harder* (04/08/2016).
- *"Having diverse learners in my mathematics classroom encouraged better class discussion, communication, participation, positive competition which was very relevant as well as engaging (5/08/2016)*".
- *"I always give my new learners a diagnostic test to assess their prior knowledge. This assists me to know the areas these learners lack or were not taught in their countries of origin (5/08/2016)*".

Mr. Erdan

- "*They did not have a supportive environment in their school that could assist African immigrant learners to transcend generally well in school environment and in mathematics classes in particular (15/07/2016)".*
- *"My hands are full. I cannot assist learners who are completely incompetent. I cannot perform miracles, their parents or the DoE should look for a means to assist these learners because they need extra care and special classes if they should progress to the next Grade. These learners are totally empty; they know nothing about mathematics word problems in English (15/07/2016)".*
- "*I am having a problem of accommodating all learners because they have different levels of understanding, some do not understand the LoLT and some are very slow in their learning. I did not do teaching course and it is a challenge for me to teach these learners. Sometimes I just continue teaching even if they do not understand so that I can cover the curriculum as required by the DoE (15/07/2016)".*
- "*Using code switching just happens naturally and I want to assist learners to understand the mathematics concepts better by using their home language by explaining big words in these mathematical word problems (15/07/2016)*".

- *"I do not want to see learners from one country (African immigrant learners) seated together they talk their language and I do not know what they will be saying, it makes me frustrated and annoyed (15/07/2016)".*
- *"I do not know what is the problem with these learners, they are passive and do not show any interest in learning. It seems as if they are lost and do not know why they are coming to school. I am not a psychologist who should counsel them (15/07/2016)".*
- "*I have an immigrant in my class* Norah, *he is quiet and reluctant to contribute in class, I think he need more time to learn about what is happening around here as he is a newcomer and a foreigner. I could see that he is afraid of other learners, but it shall pass (15/07/2016)".*
- "*We do not have enough time for extra classes as we are supposed to finish the work schedule according to the requirements of the WCED (15/07/2016)".*
- "*I do not know exactly what these learners covered, how they performed previously in mathematics therefore, I do not have their learning background which makes it difficult for me to assist them and have programs that could make them succeed in mathematics (15/07/2016)*".
- *"These immigrant learners need more time to cope with the language and mathematics content, they waste time for local learners therefore, we are disadvantaging citizens by trying to assist these foreigners, and I think it is better to look for a special school for foreigners (15/07/2016)".*
- *"These learners are not able to give me correct solutions because they cannot understand English the LoLT which is a major challenge I have (15/07/2016)*".
- "*It is difficult to find participant learners' level of understanding as I do not have any document that shows these learners' level of education (15/07/2016)".*
- "*Immigrant learners have a tendency of memorizing formulas that come into their mind first (15/07/2016*".

Mr. Maomanii

- "*All teaching activities are conducted in LoLT, which sometimes result in these learners experiencing limitations in language that result in limitations in learning (5/08/2016)*".
- "*I have seen that some immigrant learners struggle with mathematical language which is so specialized (mathematical technical terms and vocabulary). I have decided to have word banks and group discussions after school for them to collaborate by sharing knowledge with each other (5/08/2016)".*

- "*Most newly arrived immigrant learners learned English astonishingly fast and they improved their English as time progressed (15/07/2016)*".
- *"I assisted my learners to complete tasks in a conducive learning environment that was accommodative to all learners (5/08/2016)".*
- "*South African learners' mathematics is lagging behind that of immigrant learners in general because they (SA learners) consider mathematics as a feared and difficult subject which is a bad mindset. These learners fear and loose interest. They do not want to work harder and persevere. It is not that the immigrant learners are talented, clever and good in mathematics but they persevere, have a positive attitude about mathematics in general despite their challenges in mathematics word problems. They always practice and ask for assistance. They are self-motivated and do not wait for incentives to do a task (15/07/2016)*".
- "*Calling parents and former students to school to assist learners in the learning of mathematics word problems was a successful way in our school. These elders were able to communicate with the African immigrant learners in their home languages to explain the concepts in mathematics word problems (5/08/2016)".*
- "*I give African immigrant learners simple content because if I give them up to standard they won't make it. They can communicate socially and I try to make them communicate in English so that they could acquire the academic language bit by bit (5/08/2016)".*
- "*I used iPads, desktops to allow African immigrant learners the chance to interact with mathematical content in a visual form (5/08/2016)*".
- "*The use of computers was an exciting moment to African immigrant learners as they were attentive when I was teaching but, were unable to use the computers in solving mathematics word problems (5/08/2016)*".
- *"It's cool for me to see learners interacting and learning mathematics word problems from each other.There were ample opportunities for these learners to talk to each other and work together collaboratively as they networked, this interaction improved these learners' language and mathematical capabilities. In fact I view immigrant learners as an asset to the mathematics classroom and school community and it is essential to have them in these classrooms as it promote diversity (5/08/2016)".*
- "*After using technology, visuals and diagrams on the whiteboard to illustrate mathematical word problem tasks, it assisted learners to understand better (5/08/2016)*".

- "*Need to cultivate a different culture in their learners, they should teach South African teachers and learners to embrace other learners from different nations who cannot speak local languages or the LoLT or even share their culture (15/07/2016)".*
- "*All immigrant learners are capable of doing mathematics. My perception is that they are always brilliant (5/08/2016)*".

Mrs. Muchova

- "*You are the only one from Congo, and I think you are going to be able to answer this question about HIV. So is it really true that Congolese people contact HIV more than other countries because of poverty and war*? *(15/07/2016)*".
- "*I am doing what I can because I cannot help them the way they want me to. This is too much demand from me. This is my first time to teach such type of learners. (15/07/2016)*".
- "*it is very difficult to teach African immigrant learners mathematics word problems, it is also difficult to complete the tasks, even though the locals try to assist them during group work, the local learners become bored and reluctant to assist these African immigrant learners because of lack of competence in the LoLT (5/08/2016)".*
- "*in my class there are many learners and it's a big challenge for me to know what they learnt from their former schools especially the African immigrant learners, how do I know that they have covered such topics and that is linked to the new curriculum as I do not know the African immigrant learners' previous curricula (15/07/2016)*".
- "*You have to find or search information or meaning of mathematical terms by yourself (15/07/2016)*".
- "*These learners are too mobile and make noise as a mechanism to cover-up their lack of communication or unable to cope with the learning situations. There are too many learners (58) in my classroom, I cannot offer immigrant learners additional support (15/07/2016)*".
- *"I find it difficult to try to teach both LoLT and mathematics word problems to these learners especially mathematics academic language (15/07/2016)*".
- "*I don't know how to cater for these learners and I do not have any skills of teaching foreign learners. I do not bother myself about asking other teachers. Even if I ask for assistance from the principal, I know that there is nothing he will do as he said that we should see what to do as this is a challenge to the school and no one is experienced to teach such learners (15/07/2016)".*

Mrs. Ihoe

- "*I viewed the immigrant learners as assets to the mathematics classroom as they offered diverse mathematical knowledge to the South African education system. Local learners, immigrant learners and all teachers belong together because we are same people. We should not discriminate but love each other as human beings (15/07/2016.*
- *"I have seen that the African immigrant learners had frustration during their first days in my class because of lack of proper communication skills when discussing mathematics word problems and they felt left out because I did not always spoon feed them (15/07/2016)".*
- *"I always allow immigrant learners to express or use any method that they know to solve particular questions. I will then evaluate and assist them. I am always researching, these learners keep me busy so that I become a life-long learner. I have to search if the mathematical methods they use are appropriate to manipulate given questions. Sometimes I ask knowledgeable (foreign teachers) people from their countries". By doing more research I prevent confusion of underrating the African immigrant learners' knowledge which could result in motivation (5/08/2016)".*
- Mrs. Ihoe from school B reiterated that: "*I found that multiplication and subtraction were done differently in other countries. I had to ask these learners to explain so that I could understand and use it as an appropriate method for South African learners too (5/08/2016)".*

  "*Meanwhile, many newly arrived learners learn English shockingly fast. Even though, there are some who are struggling but the majority of these learners are keen to learn and always ask for assistance. They always like to learn and discover (15/07/2016)*".
- *"We are not having a lot of problems in teaching these immigrant learners now as before as we are working with refugee agencies like the Agency for Refugee Education, Skills Training and Advocacy (ARESTA) that have program to integrate these learners into the school community. They have tutoring and afterschool classes to assist these learners. We also have parents who are good in mathematics who are from the same countries with African immigrant learners who provide weekend classes to these learners in their home languages or by code switching so that they could not loose English or their home language completely (5/08/2016)".*

- *"Our school provides a welcoming environment to new immigrant learners through engaging them in mathematics clubs and games that demands use of mathematics word problems (5/08/2016)"*.
- "*I had to vary my questions to different levels as to include all learners especially the African immigrant learners as they had difficulties with the LoLT in mathematics word problems (5/08/2016)*".
- "*Sometimes we cannot work on our own as it will be of higher level and difficult to us (15/07/2016*".
- "*I try by all means that my learners understand the mathematical vocabulary, language and terms not by nodding but by actually understanding and comprehending through tasks (5/08/2016".*
- "*We experienced problems during the first days of enrolment but later it was easy because we have a programme that assist such type of learners. We group them and ask assistant teachers from their countries of origin to teach them" this is one of our strategies we have adopted. After these programmes these learners are able to cope with the type of curriculum we offer. We also have reading, debating programmes where we encourage respondents to share information, by doing so they will be learning and gaining language (LoLT) proficiency. It is not only African immigrants, we also have some from Bangladesh, Pakistan and Chinese learners (15/07/2016).*"
- "*I cannot reach to the needs of all learners as they are many, diverse which is a challenge for translation or group them as they cannot communicate in English. So I just teach them survival language skills and a little of academic vocabulary bit by bit. I always try to determine the prior knowledge learners bring to classes and plan the lesson from that point (15/07/2016)*".
- "*African immigrant learners had an attitude of making sense of mathematics word problems and persevere in solving them (5/08/2016)"*. She continued to aver that: "*African immigrant learners are my best learners they are intrinsically motivated, they have a culture of learning, and they go an extra mile with their work despite having challenges with mathematics word problems (5/08/2016)".*

Mrs. Mwesto

- "*I don't have experience of teaching immigrant learners, but I have such learners in my class, what I should do then, and no assistance from the DoE, and even from the school itself. It is a one man's journey that I am travelling because of teaching mathematics (5/08/2016)"*
- *"These learners are not able to read or write in English or even in their home language (15/07/2016)".*
- "*I cannot speak or communicate in African immigrant learners' languages therefore, it is a challenge for me as I cannot be able to simplify my explanation of mathematics concepts in their home languages to make them understand the mathematics word problems better. Moreover, I cannot use code switching in their languages as I do to South African learners (15/07/2016)".*
- "*There is nothing that I can do because I cannot speak the immigrant learners' home languages. If I could speak their languages, I could also explain in their home languages, then it is bad luck for these learners (15/07/2016)*".
- *"Immigrant learners are challenged with understanding mathematical terms and they become confused as some mathematical terms have different meanings in everyday use such as concepts like function (15/07/2016)'.*
- "*I do not know how to simplify mathematical terms to learners in a better way for them to understand easily (15/07/2016)*".
- *"the major problem we have is that we are all new from the university and using that little knowledge we have, We did not have any training in teaching this group of learners (African immigrant learners) and we then meet this new group of learners and we are not experienced and cannot be able to teach them effectively (15/07/2016)".*
- "*They (*African immigrant learners*) may say a word and when you ask them the meaning or the symbol represented by the mathematics they are unable to write it down or define it or even identify the term (15/07/2016)".*
- "*I do not know any one of the languages of these immigrant learners except the local South African learners. I can only assist local South African learners when they have problems with the LoLT in mathematics word problems and translate or use code switching (15/07/2016)".*
- *"I am having challenges with mathematics word problems and cannot teach it confidently therefore, I just give learners to do on their own and does not provide*

feedback. I did Mathematics Literacy only at University but I was given mathematics, I am qualified to teach Mathematical Literacy and IsiXhosa as they were my major subjects at university (15/07/2016)".

- "L*earners should be independent and able to work alone since in the examinations they work alone there is no group work, I have to train them now before they write examinations (15/07/2016)".*
- "*These learners are too reserved, they do not want to talk or even associate with local learners, these learners need to be isolated from local learners. They are too passive and are used to teacher-centred approach, however, the interaction of immigrant learners with local learners and me is better now as compared to the time they arrived and before the intervention programme (5/08/2016)*".
- "*The African immigrant learners I am teaching are struggling a lot to learn English and algebraic word problems which result in them being left behind during my lesson (15/07/2016)*".
- "*I am not good at mathematical word problems, so I skip or ignore some of the difficult mathematical terms as well as word problem tasks as I did not train for mathematics but Technology (5/08/2016)*".

Mr Watso

- *"This is a problem to me, the principal just gave me this class, I even told him that I cannot teach in English only because English was not my major subject and he refused and forced me to teach this class. Now I meet these foreigners, they cannot speak or can barely speak simple English (basic) what about mathematical terms in mathematics word problems (15/07/2016)*".
- "*My first few days when I had these learners (First week of January). I thought they had learned mathematics in English. I did noticed when I gave them mathematics word problems for them to read and to solve. These learners struggled a lot in reading and explaining the meaning of mathematical words to interpret what the question meant. That is when I understood them and had to talk to them personally and then found out that they did mathematics in French (5/08/2016)*".
- *"to tell you the truth, these immigrant learners need a lot of help, it is tiring to teach these learners, they always ask for help, from the capable ones (local learners and teachers) which means that there is always a conflict of interest among local and African immigrant learners when working in groups. By this it makes immigrant*

learners more confused and feel unwanted or uncared for by the local learners and the teachers (15/07/2016)".

- "*I only teach as what my previous teachers did through code switching (15/07/2016)*".
- *"How can I use code switching to such a diverse class? I do not speak all these languages. This is a very big problem for me. The DoE, school do not support me. Even if I use code switching it is waste of time and energy as only South African learners speak my language IsiXhosa because I have Somalis, Sudanese, Burundians, Ethiopians and Congolese (15/07/2016)".*
- "*By having immigrants at our school it could result in having foreign values which purports tarnishing of South African precious values (15/07/2016)".*
- "*There is nothing I can do, maybe we need people who can speak their languages, the DoE should build or make schools for these learners as they are a burden to us we are being stressed with these learners (15/07/2016)".*
- "*It will be beneficial for teachers to be trained to teach ELLs or schools should have ELL teachers to support other teachers in teaching these diverse learners in schools*".
- "I am new in the *teaching so I have not yet have a situation of teaching a class with foreigners. This is a challenge to me. How am I going to cater for their learning needs (15/07/2016)".*
- "*I have no idea as to cater for this group of learners (*African immigrant learners*) as I do not have any skills for teaching such type of learners (15/07/2016)".*
- "*I do not know why the principal enrolled these learners? Did he check their records for previous Grades? May be that is why these learners are having problems with mathematics (15/07/2016).*
- *"some of these learners have basic communication skills. They talk but cannot read or write what they are saying (15/07/2016)".*
- "*My major problem is that mathematics word problems have specialised language which demands mathematical comprehension when finding solutions (15/07/2016)".*
- "*I did not train for mathematics but due to a shortage in the Mathematics department I am teaching mathematics instead of Life Sciences as I did mathematics at first year level only, it's really difficult for me to teach this subject (15/07/2016)".*

Ms. Mdamanest

- *"Simbe, if you do not understand the terms used you can go and use the Mathematics Dictionary as well as Grade 9 and Grade 8 text books for better understanding, this material is for Grade 8 and 9 and should be easy to understand (15/07/2016)"*. she stated: "*I am not comfortable with Financial Mathematics, I also did not do this topic at high school and university, at least it is better for these learners because I am guiding them and they should do more practice on their own (15/07/2016)*".
- *"Immigrant learners nag me a lot and I told them not to nag me again because I am not learning for them and that they should study and work independently. I am there to facilitate. Even working in groups is not about choosing your own group. No learner should be in a group of their choice (in their comfort zones) (15/07/2016)".*
- *"I had no experience of teaching different learners from different countries, I was unable to cater for all immigrant learners as they were unable to communicate well in the LoLT (15/07/2016)".*
- *"After six months immigrant learners were able to converse in the BASIC language but having problems with the CALP language however, there were some improvement as compared to the first months they arrived here (15/07/2016".*
- *"I find it difficult to teach mathematics word problems as these learners cannot comprehend the concepts and worse off they cannot read or communicate in the LoLT and mathematical terms and the mathematics vocabulary seems to be a challenge to these learners. Therefore, I just do the arithmetic problems which may be easier and straight forward so that I can complete the mathematics content as required by the DoE (15/07/2016)".*
- "*African immigrant learners are not sociable as they distance themselves from local learners (15/07/2016)".*
- "*My perception of immigrant learners was that they are not capable of doing mathematics. I underrated them, however, in general mathematics they are so good they only experience problems when using mathematical language, which is a problem with all learners but more on these African immigrant learners. (15/07/2016)".*

Appendix P: interview responses for participants (Immigrant Learners).

Muthuli

- "*From my own experience, if anyone could have visited our class he or she could say I was a very quiet leaner but, I could not say anything as I could not speak the LoLT and was not able to participate fully in mathematics word problem classes (15/07/2016)".*
- "*The language used in mathematics is confusing me, it is difficult to understand as there are a lot of new words or vocabulary (5/08/2016)*".
- *"I lied about my Grade and said that I did Grade 10, now I am struggling. Please do not tell anyone that I lied (15/07/2016)".*
- *"No one wanted to work with me in their groups, I just sat doing nothing during group work, and the teacher did not even assisted me to be incorporated into other groups".*
- "*I am hesitant to speak and contribute in class because I am the only foreigner in my class and newcomer (15/07/2016.*
- "*I was the only foreigner in my class, feeling very different, marginalised and very isolated. I felt incredible distinct from the group and extremely disconnected (15/07/2016)*".

Gurazzy

- "*Our teacher tries his best but, we cannot understand him because of the English, then it seems as if we are not being recognized as we see the teacher as not doing much to assist us (5/08/2016.*
- "*Our teacher always uses examples similar to our culture. He gave us some questions similar to what we did in our home countries, I felt so excited, motivated and valued (15/07/2016)".*
- *"I was very good in mathematics in my country, but, now I am performing poorly because of the language (English) I am using (5/08/2016)".*
- "*I found comfort at school in mathematics classes as teachers included us in all learning activities. Sometimes the teacher could take photos of us with others or videos when having mathematics discussions and presentations. I liked it because it reminds me about my first days learning mathematics in English. I felt a member of the class and recognized by my new teacher and classmates as time progressed (5/08/2016)".*

Janice

- "*I haven't had that experience in my life where a group of strangers care so much. It was a human thing, very nurturing support. I felt closely, incredibly and deeply connected with the teacher and some learners in my class (5/08/2016)".*
- *"I like mathematics but the language we are using is difficult as compared to the one used in my previous country".* "*These learners seems as if they are in lower Grades as they are not understanding certain mathematical concepts due to their lower LoLT proficiency despite the fact that they can communicate socially and this is a challenge for me to include them fully in the learning and teaching process (5/08/2016)*".
- "*our teacher have a lot of reading material in his classroom. During lunch or break we stay in his class reading the information on the charts and walls. There are examples, pictures and mathematics stories. It is so interesting; I love mathematics, even if it is difficult for me with some of the big words (5/08/2016)".*
- *"I like doing mathematics word problems with local learners as I also make new friends who will assist me with my education.It was a great surprise for me being in a class with people speaking different languages from mine working with me, but, 'black like me'. I was able to work with them cooperatively (5/08/2016)".*
- "*we always go to the teacher after school to ask for more clarity. Luckily my teacher (Mrs. Ihoe) is a lovely one she always help us where we have learning problems when she is free (15/07/2016)*".
- "*Our teacher put us in one group of foreigners from the same country. We were able to use our home language, French to manipulate the word problems. It assisted me because I had many conational who were explaining to me so that I could understand the concepts in the word problems. Another learner in our group was good in mathematics and was able to explain to us than the teacher, he explained slowly and patiently for us to understand better. He was better than the three of us. I was so comfortable to be grouped with learners from my country (5/08/2016)".*
- *"I am not shy I persevere and this will show my capability, if not good I learn from others, I like competition so I would like to show them that I also know my mathematics word problems and that I am intelligent (5/08/2016)".*

Lube

- "*it is very difficult to discuss with local learners because we do not know what the statements say, it makes matters worse we do not know English. I wish, I could learn in a class that offers my language or be taught by a teacher from my country so that he or she can assist me or show some care and love for me to learn mathematics and pass, as he or she knows my challenges better than the local teacher (15/07/2016)".*
- "*During my first days here in South Africa, I felt isolated by South African learners, no one wanted to sit next to me or even talk to me. They were teasing me, making all the funnies with my accent, dressing, hair style, when the teacher asked for my introduction. Some of them asked me if I have ever used a computer and know what a phone is. I tried to explain to them but they laughed at me as my English was broken (They called me names like Dom, Baro (stupid) or fool in their language) (15/07/2016)".*
- *"After having a class discussion, I had problems in understanding the content under discussion, I went to the teacher for assistance, unfortunately, the teacher seemed not to care or bother about my challenges and he did not provide any help (15/07/2016)".*
- *"Our previous teachers always used to assist us when we had problems, but, now we are having difficulties because this teacher does not explain and assist us, I will fail mathematics (5/08/2016)".*
- "*I had a "double trouble" because my mathematics was bad too; English was bad because I could not understand some English terms since I learned in Bari in my country (15/07/2016)*".
- "*Even if I had friends who spoke my home language and other acquaintances, there was no appropriate interaction or connection with local South African learners as they were excluding us from their groups and I felt so lonely (15/07/2016)*".

Mubarak

- "*Mathematics here is difficult as compared to Somalia as we are doing in English here (15/07/2016)".*
- "*Our teacher (Mrs. Mwesto) always do it and she code switch a lot without taking care of us, she is rude, and sometimes she threatens us to fail if we report her to the principal. We are afraid, she does not teach us because she uses Afrikaans every time but, we are*

in an English class which is supposed to use English only in the learning and teaching of mathematics (15/07/2016)".

- "*There is always someone in the classroom who will treat us differently (15/07/2016)".*
- "*I do not think I belong here, these people do not think I belong here. These people they do not like us, the teacher segregates us and we are seen as foreigners or invaders (unwanted, poor and dull learners) (15/07/2016)".*
- "*I always do my mathematics at the mosque where we are taught nicely and our teacher at the mosque moves around explaining to everyone in our language. It is not like here at school where the teacher tell us to do mathematics word problems alone and he sits on his chair. The two mathematics are different and I am confused at school because this teacher is rude and does not explain and she always scold us saying 'magweja', 'Ikwerekwere' I hate this Mistress a lot because she hate me. This teacher does not care about us foreigners because she does not assist us foreigners but locals only (15/07/2016)".*
- "*Word problems are difficult for me because I cannot understand the language used as I confuse the words used like more than and quotient (15/07/2016)*".
- "*What is perceived about Muslim people by the entire world (terrorist) therefore, local learners did not associate with me*? *(15/07/2016).*
- "*I felt frustrated that I was unable to demonstrate my true understanding of the text because I lacked the vocabulary to discuss the mathematics word problems with other learners (15/07/2016)".*
- "*I cannot understand English as I used Bari [a Sudanese language] at school in all my subjects and I have stayed out of school for three years (15/07/2016)*".

Danest

- "*Our teacher speaks very fast, he explains fast such that we are left behind as do not understand properly and our teacher does not explain key words or new terms to us. He does not give us time to think or to understand so that we can assimilate the taught content (15/07/2016)".*

- "*I had a problem with the English and the words '12 more toys than', 'one more' 'double' and 'simplified algebraic form' as written in the above question (15/07/2016)".*
- "*This word problem designed by the teacher made me stressed and I felt a little tense because I felt as though they were stereotyped questions. (15/07/2016)*".
- "*When our teacher explain mathematics word problems in another language (Afrikaans) that we do not understand I become confused because I do not know Afrikaans (15/07/2016)*".
- *"I was surprised that Ms. Mdamanest wanted answers from us because she does not even want us to present or give answers in class, she hate foreigners may be she changed today because you are around, then she acts as if she cares (15/07/2016)".*
- *"I think of running away from the class because its English every time and I do not understand it, I cannot even speak it as it is difficult and new to me. My parents do not help me even with homework and I am left alone. It is better to abscond the lesson or to drop out of school because it is too much for me. I used to like learning in my country but, here it is more than a jail or punishment if I go to school. You do not feel free you are like a prisoner. Local learners and the teacher isolate me as if I am stinking or I am mad or crazy (15/07/2016)".*
- "*My own thinking is that these people do not want to associate with me because I am a foreigner and have come to their school to take their education (15/07/2016)*".
- "They said that *Gweja, Dakkie, and Swart we cannot work with you, you think you are smart (15/07/2016)*".

Ema

- "*I cannot understand mathematics word problems but can do better in other areas like simplify, solve equations as I am not proficient in LoLT (15/07/2016)".*
- "*I became lost when answering mathematics word problems in the mid-year examinations as I lacked the skills of reading and understanding mathematics word problems (5/08/2016)*".
- "*Mathematics word problems are difficult for me. I do not understand them (5/08/2016)*".
- "*I do not have anyone to work with, I am left alone, I feel lonely, bored and want to drop schooling the teacher uses his home language in teaching us (15/07/2016)*".

- "*We are not allowed to talk to elders and seat next to them even to have physical contact. Therefore, we keep a distance as it is our culture (15/07/2016)".*
- *"We usually do mathematics individually if you talk to someone next to you, the teacher will reprimand you, and he did not want us to work as a group (15/07/2016)".*

Simbe

- *"So what is the need for coming to school if I always get zeros in these mathematics word problems? I used to be a best learner in mathematics in my country but, now this topic is giving me problems, other topics are better but mathematics word problems are a challenge to me. I hate this topic because it is English only which is a difficult language to me. I am not an English speaker (15/07/2016)".*
- "*I can speak English because my friends in the location or community assist me very much as we play together, but cannot understand the English used in mathematics classes (15/07/2016)".*
- *"Our teacher struggles a lot in solving mathematics word problems, he makes us more confused. I think he is not qualified to teach mathematics because the answers that he get are different from the ones we have at the back of our textbooks, I even asked another teacher to solve the mathematics word problems for us after school and he got the answers that are in the textbook. I can't trust him anymore (15/07/2016)".*
- "*I was isolated and enveloped in a classroom that did not recognise me may be because of my bad English (15/07/2016)*".
- "*It was difficult for me to settle in a mathematics class as I heard new different languages spoken in my classes. I could not understand the language used by both the teacher and the local learners, all these languages were totally new to me (15/07/2016)*".
- "*Our teachers and the South African learners treated us with disrespect, they bullied us. They did not want to see us happy and always talk behind our back, our teachers did not treat us as human beings like SA learners, and they scold us and always say rude words (15/07/2016)".*
- "*When we arrived here my teacher didn't want us to speak in my language or even assist us when we struggle with word problems (15/07/2016)".*

- "*My English is bad therefore I cannot communicate with local learners because they are better than me and they will see that I speak broken English (15/07/2016)*".
- *"The teacher always assists South African learners, who are we to be assisted since we are foreigners and unseen by teachers. He does not see our presence (15/07/2016)".*
- '*I have not had a chance to interact with my teacher meaningfully (15/07/2016)"*.
- *"I felt so isolated because I was not able to have teachers who could attend to my problems or even having a local friend to interact with (15/07/2016)".*

Norah

- *"Barrier to communication in class made me feel isolated as I always ask myself questions as why can't I speak to others in class and hear what they are discussing during mathematics word problems. It is difficult for me to fully participate in class (15/07/2016)"*. Norah from school B stated "*I felt out of place and inferior as I had never seen or used a computer in my country (15/07/2016)*".

Gumaka

- "*Having grown in the countryside of DRC in a remote rural area, I had never had a computer, cellphone or learned using a projector or whiteboard (15/07/2016)".*
- "*Using computers was difficult for me and it resulted in me getting lower grades as compared to my previous school in my country of origin. I did not know how to use the computer. No one assisted me or even explained to me how the programs or activities on the computer were done, even the teacher did not assist me, I had to ask other learners for assistance. It was a difficult experience to me as I felt excluded or lonely in the new situation. However, through much practice I am able to use the computers and I have gained a lot (15/07/2016)"*.
- "*I had problems to understand financial mathematics topic as it has a lot of words and it was a new topic to me in Grade 11 as local learners had done it from Grade 8 (15/07/2016)".*
- "*I am not performing well because the teacher is not assisting me as well as the SA local learners do not want to share information with me "(15/07/2016)"*.
- "*We were given names to describe where we come from (15/07/2016)*".

Abdullah

- *"Local learners use their language; therefore, what do you expect me to do. It means that they are chasing me away from their groups and I feel excluded (15/07/2016)".*
- *"I hate coming to school as I am always behind local learners they have done some of the information therefore, I feel so dull and embarrassed*".
- *"I just sit at the back of the classroom so that other learners and the teacher cannot notice my presence, I cannot communicate in the LoLT, therefore, what should I do to communicate with others (15/07/2016)".*
- *"I know how to add them. I did not know the meaning of the word problem that I should add the numbers (15/07/2016)*".
- *"We have been victims of insults from South African teachers and learners. I am very good in mathematics and I am the best in class in other topics except mathematics word problems. Some SA learners are jealous and they hate me as one said to me. How do you become so good in mathematics if you are not good in English? Go back to your country you want to act as if you are clever. Do you think you belong here, you are a foreigner you cannot be good in mathematics (15/07/2016)".*
- *"sometimes I get new and difficult words in mathematics word problems that I do not understand but the teacher does not try to explain and he just refer us to use my home language dictionary and search on the internet which I do not have (15/07/2016)".*
- "*We were not allowed to work together as boys and girls in our culture because men and women do not mix, therefore we cannot ask a female teacher to meet her in private during her free time. It is a taboo in our culture. Our teacher emphasized on individual work, our teacher always said that we should not talk or assist others "each man for himself" was our teacher's motto(5/08/2016)".*
- "*When local learners told me that I am related to Bin-Laden because my name is Abdullah Bin-Laden. I fought with one boy when the teacher grouped us to do word problems together when he said that I was related to the terrorist Osama Bin-Laden. There are a lot of problems I faced from the interaction with local learners. The teacher did not support me but took me to the principal and called my parents to school. Due to language problems my parents were not able to explain or converse well with the teacher, principal and the boy's parents. Therefore, I was suspended for a week. But, what can I do since I am a foreigner (15/07/2016)".*
- "our*teachers do not pay much needed attention to us in the learning of mathematics (15/07/2016)*".

Ababa

- *"Our new classes are so nice with a lot of computers and internet, in our country we did not use computers and even know them, we were learning in muddy classes without electricity (15/07/2016)"*.
- "*Our previous teachers in our home country read, directed, assisted and solved questions for us when doing mathematics word problems in my language (15/07/2016)*".
- "*Using computers was an exciting experience to me, I was able to learn new things and working alone, however, it was difficult for me at the beginning because it was my first time to use a computer (15/07/2016)*".
- "*Mathematics here is having a lot of words and not solve for x, but you have to read and come up with the answer* (*15/07/2016*).

Rana

- "*This is my first time to have my own textbooks and use a computer. There is nothing like using computers in my previous country. It is only chalk and talk. We used to share one textbook among five learners. Therefore, I did not have a chance to take even one textbook home and practice. I am so blessed to learn at such school (15/07/2016)*".
- *"The moment I hear a teacher who communicated in my language, I was excited and happy and asked the teacher to assist me as he knew our language and could explain better in my language (5/08/2016)".*
- "*In our country of origin, the teachers were refusing to help us because they claimed to be busy but here teachers are helpful and always available and willing to assist us (15/07/2016)".*
- "*I like our mathematics teacher, he always assist us when we approach him. He is friendly and act as a parent to us. He goes to an extent of asking about our social life like food we eat and if we have eaten. He cares so much that he even called my father to discuss about my performance first term of my studying here in South Africa. I was not able to speak or read English statements. I was able to get a conational tutor who was found by my teacher to assist me with my school work (5/08/2016)".*
- "*SA teachers are so helpful because they do not punish us or beat, they respect our humanity, and I like to work with them because they are "smart". Our teacher is a free*

person because if I do not understand something in class he will always assist us and does not become angry or bored with us (5/08/2016)".

- "*I feel confident when speaking to others, even though my English is not perfect, my friends encourage me to continue talking, and they did not laugh at me either (5/08/2016)".*
- "*The mathematics language used in the mathematics word problems is difficult, sometimes it confuses and you do not know which mathematics procedure to use (5/08/2016)*".

Chinjo

- "*I hate to work in groups, I sit and keep quiet because I do not understand what the locals say and I cannot speak English and their language. They use their home language therefore; it is the same as if I am not taking part in the discussion (5/08/2016)*".
- "*Here you can research and get marks that counts to your report as compared to DRC you only have marks for examinations and no continuous assessment marks (15/07/2016)".*
- "*We spent a lot of time out of school because we were crossing boarder to boarder on foot until we came to South Africa that is why I cannot understand the mathematics I am learning (15/07/2016)*".
- "*I learnt only one month, came and sat at home looking for schools and my parents did not have proper documents (15/07/2016)*".
- *"What our teacher does is to sit and read the newspaper, busy with phone, he just gives a page to open and write the work without explanations, no marking, no assistance and no corrections, and how we can pass without a teacher teaching us (15/07/2016)".*
- "*My teacher is very rude and unhelpful, when you ask a question she will tell you to think and search for the answer and say that where were you when I was teaching, I cannot repeat what I said*". *Our teacher demoralise one's spirit for doing or liking mathematics word problems maybe he does not like this topic (15/07/2016)*".
- "*Our teacher does not allow us to ask our friends if we have problems, he always wants us to think and use our brains also saying that we are lazy and noisy (15/07/2016)".*