

**CHALLENGES ENCOUNTERED BY TEACHERS WHEN TEACHING FRACTIONS IN
GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE**

by

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DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo, for the degree of Master in Education in Curriculum Studies has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

.....

Masenya, MN (Ms)

.....

Date

DEDICATION

To my adorable progenies Morotha and Kokotla:

I know you have dreams to your future and to realise your ambitions it acquires an awful lot of willpower, devotion, self-control and exertion to achieve them. Always remember that, to accomplish your dreams you do not have to put in half of the effort unless you are okay with half of the results.

The study is also devoted to my late grandmother, Makweya Salome Masenya who always possessed a passion for education even though she did not attend school.

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“Ke a leboga Bakone”.

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LIST OF ACRONYMS

ANA	Annual National Assessment
CAPS	Curriculum Assessment Policy Statement
CASS	Continuous Assessment
CCSSI	Common Core State Standard Initiative
CIEAEM	International Commission for the Study and Improvement of Mathematics Teaching
DBE	Department of Basic Education
DHs	Departmental Heads
DHET	Department of Higher Education and Training
DHs	Departmental Heads
EFA	Education for All
ICT	Information and Communication Technology
IE	Inclusive Education
LTSMs	Learner Teacher Support Materials
MLSC	Mathematics Learning Study Committee
NAPTOSA	National Professional Teachers' Organisation of South Africa
NCR	National Curriculum Review
NCS	National Curriculum Statement
NEEDU	National Education Evaluation and Development Unit
NNS	National Numeracy Strategy
NRC	National Research Council

OTL	Opportunity to Learn
SACMEQ	Southern and Eastern African Consortium for Monitoring Educational Quality
SMT	School Management Team
SIP	Subject Improvement Plan
TREC	Turfloop Research Ethics Committee
UNESCO	United Nations Educational, Scientific and Cultural Organization
ZPD	Zone of Proximal Development

ABSTRACT

The purpose of the research was to explore challenges encountered by teachers when teaching fractions to learners in grade 2 at schools in the Koloti Circuit. A qualitative approach including other research techniques, such as observation, document analysis and interviews, were mutually employed to collect data during the study. A pluralistic approach was employed when gathering data to enhance triangulation and further intensify the merits of the probed facts. Purposive sampling was employed to choose three grade 2 teachers from various schools to serve as participants in this study. The following challenges were uncovered as a result of the research: learners are from child-headed families; there is a high rate of learner absenteeism; parents do not attend consultative meetings; there is a high rate of teacher time-offs; there is a lack of teacher pedagogical content knowledge in mathematics; teachers have to teach in multi-grade classroom; teachers lacking background knowledge on implementation of inclusive classrooms resulting in inadequate support to learners with learning barriers; classrooms are over-crowded; uneven partitioning of circular representations was discovered, and there is lack of content-related workshops. The following were some of the recommendations that were established to counteract the challenges uncovered during the research study, namely: establishment of after-care centres with qualified tutors; provision of state paid security services in schools; teachers should create learner support materials to aid in the teaching of fractions to the learners; teachers should notify parents when their children are absenting themselves from school on regular basis without valid reasons; teachers should notify parents about the benefits of attending consultative meetings; memorial services for teachers should be conducted after learner contact time, competent and/or qualified teachers in arithmetic should be assigned to educate the subject; small schools should be merged to curb multi-grade teaching at schools; more classrooms should be provided to avoid over-crowding in the classrooms, and more content workshops should be organised in order to assist teachers who experience challenges with the teaching of fractions. In conclusion, the outcomes of this study could aid grade 2 teachers in instilling knowledge of fractions into their learners, crafted on the suggested recommendations that are drawn subsequent the challenges facing teachers were singled out, in order to improve learner performance

in fractions. This could result in better performance by learners in mathematics at various schools.

Keywords: mathematics; fraction; foundation phase; grade; learners; teacher; teacher content knowledge; contextual knowledge; teaching approaches.

CHAPTER 1

RESEARCH ORIENTATION

1.1. OVERVIEW AND CONTEXTUAL RESEARCH

Mathematics is a form of knowledge which deals with mathematical calculations and dimensions, including the unravelling of obstacles that each person needs to employ in different situations (Tatira, Mutambara & Chagwiza, 2012). Unsatisfactory execution of this branch of science, which deals with numbers, fractions, quantities and space, is a concern for the majority of learning institutions in the world (Human, van der Walt & Posthuma, 2015). This was revealed by both national systematic evaluations, as well as by international and regional studies which revealed that learner performance in most South African schools is currently at stake due to poor performance in mathematics (Kaino, Dlamini, Moshe, Phoshoko, Zingi, Paulsen & Ngoepe, 2015). Tachie and Chireshe (2013) also divulged that learners endorsed their failure mainly to external factors such as lack of human and material resources, poor teachers, poor teaching methods and bad teacher behaviour and also to internal factors like laziness by learners, their lack of interest in the subject and learner truancy. The section above highlighted that there is a global challenge of learners performing dismally in mathematics as a subject.

To support the above section, the researcher engrossed this study mainly on fractions as an obstacle to most of our learners starting from foundation phase level. To defend what the researcher has just highlighted, Braithwaite and Siegler (2018) revealed that countless learners' knowledge of fractions is poorly affected by whole number bias, the trend to concentrate on the separate whole number components of a fraction instead of on the fraction's size. Consequently, understanding fractions is critical to mathematical development, yet many children struggle with fractions even after years of instruction (Braithwaite & Siegler, 2018). However, computation information as well as system benchmarks are not yet outlined for training of foundation phase student teachers in South Africa (Human, van der Walt & Posthuma, 2015:1) in order to improve fractions learner performance in the

foundation phase. Furthermore, general investigations showed that learners from most of the schools in South Africa leave foundation phase with a poorly developed sense of numbers and are unable to face the challenges of more advanced mathematics at a later stage in their school careers (Graven, 2015). South African learners are, therefore, expected to acquire solid foundations in fractions in order to improve their mathematics performance and participate effectively and contribute to the world in which we live (Graven, 2015).

1.2. PROBLEM AWARENESS

The researcher's preliminary observations as a school principal identified similar trends as indicated in the above section. The researcher came to identify the problem when conducting class visits in grade 2 at the school where the researcher is currently employed and again the problem was further identified when grade 2 teachers submitted their mathematics learner scripts for moderation purposes to the departmental head that partitioning of circular representations amongst two or more people is a challenge to these learners. The researcher went further to share the identified problem with other principals from the neighbouring primary schools during formal accountability sessions that are held in the circuit on quarterly basis. In this meetings all the principals in the circuit present their quarterly learner academic performance to the circuit manager and all the other principals.

Indeed, learners at the school where the researcher is working, as well as the neighbouring schools in the same circuit, exited foundation phase with a lack of knowledge of mathematical concepts, based on the reports that are presented during the quarterly accountability sessions at circuit level. This is justified by the circuit results for mathematics starting from grade 4 upwards up till grade 12 together with the inadequate performance of grade 3 learners in the 2010 ANAs, where they recorded an average mark of 28% for numeracy (DBE, 2011; Graven & Venkat, 2014).

In all the primary schools in the circuit, foundation phase mathematics learner performance is pleasing when they exit foundation phase, but surprisingly, the very same learners when they get to grade 4, there is a huge difference with regard to their mathematics results as compared to the ones they received while still in foundation phase. The same results that are displayed in grade 4 mathematics performance deteriorate on annual basis as the same learners progresses to higher grades up till grade 12. This is an indication that, the problem started in the foundation phase where the researcher assumes that teachers are having challenges in teaching mathematics, more especially fractions as it serves as the basis for most of the topics in mathematics such as percentages, ratio and proportion. This was an important factor that motivated the researcher to conduct research related to the problem alluded to above, focusing specifically to grade 2 since it is the middle grade in the foundation phase. The researcher therefore believed that, focusing on grade 2 will yield desirable outcomes since if there are any challenges encountered they could still be resolved as these groups of learners would still be in the foundation phase the following year. The problem statement below, therefore, expands upon the nature of the problem.

1.3. PROBLEM STATEMENT

Fractions constitute an obstacle to primary school learners, as the study of fractions entails the acquisition of deep-rooted abstract information on part-whole relationships, measurements and ratios (Bruce, Chang, Flynn & Yearly, 2013). Foundation phase learners find it difficult when dealing with partitioning of circular representations, as they end up with uneven parts and only rely on tallying the number of segments, shaded with the number of segments needed, as per the fraction given, without considering the magnitude of the segments that are partitioned (Bruce et al., 2013).

Tian and Siegler (2017) revealed that, the 2010 Common Core State Standard Initiative (CCSSI) divulged that novices are expected to expand their comprehension of fraction magnitudes in order to enable them to apply the acquired knowledge to questions concerning word sums, fractions, frequencies and percentages in senior

classes. Similar trends of the type of problems indicated above seem to manifest themselves within both the school where the researcher is working, and the neighbouring schools in the same circuit. Indeed, in relation to learning about fractions, learners at the grade 2 level in this specific school, where the researcher is a principal, find it difficult when they are expected to partition a whole into various parts. They do not consider the aspect of equal parts when partitioning wholes into fractions; they only consider the correct number of pieces needs to be shaded, while the shapes sizes are not equal. This is an indication that the conceptual understanding of fraction mathematics by the learners is a serious problem.

Nationally, the absence of mathematics teacher content knowledge, insufficient qualified-competent teachers, utilisation of out-dated teaching practices as part of the problem, contribute to a lack of conceptual sense of mathematics at the primary school level (Venkat & Spaul, 2015). The lack of mathematics teacher content knowledge contribute negatively towards learner achievement in fractions in the sense that knowledge for teaching varies greatly from knowledge for doing in a particular subject because by simply knowing more about a subject does not guarantee that one can teach it in ways that qualify learners to acquire the mathematical power and deep conceptual mathematical perception projected in modern modified documents (Mewborn, 2001). However, numerous teachers are not capable to deliver conceptual clarifications for the practical assignments that they do because they lack an understanding of quotitive (measurement) division and are inclined to depend only on a partitive (sharing) interpretation of division (Mewborn, 2001). This becomes a challenge in the division of fractions where it is almost difficult to make sense of the fundamental concepts employing a partitive interpretation of division (Mewborn, 2001). Li and Kulm (2008) further disclosed that the effect of insufficient qualified-competent teachers on fractions learning is as a result of numerous specialised training undertakings which do not dispense the anticipated outcomes in developing what teachers need to know for refining teaching and this displays the concern that we have partial understanding of the nature of mathematics knowledge teachers needed for teaching. Mubaslat (2012) highlights the importance of not employing outdated teaching strategies by indicating that a valuable strategy to boost learning is by using numerous teaching strategies such as

games and visual aids when teaching in order to assist learners to have a broad comprehension of the learning concepts and also teachers should consider the benefits of various teaching strategies as is the ability to net learners' attention; lower learners' stress; and give learners the chance for real interaction. Mubaslat (2012) further revealed that teachers need to evaluate how to employ such strategies correctly in the classroom. Overcrowded classrooms and scarcity of resources have also been identified as contributing factors (Siyepu, 2013). Maharaj, Brijlall and Molebale (2007) argued that overcrowded classes make it tough for teachers to finish the specified curriculum content.

The researcher's preliminary observations, as a principal, suggested the existence of similar problems as those alluded to above in her school, and in the neighbouring schools within the circuit, especially in relation to the content and conceptual expertise of the teachers teaching mathematics. It was the researcher's assumption, which was shared with other principals from neighbouring schools as informed by preliminary observations, that the majority of grade 2 teachers encountered problems when teaching fractions to these learners. The researcher therefore sought to investigate where these problems emanates from; i.e., whether the problems lie with the teachers' conceptual understanding of mathematics or are as a result of a lack of advance preparation for their lessons which contributes to their inability to transmit that knowledge effectively to their learners, or whether there may be other conditions at play that contribute to the problem. It was with this in mind that the researcher explored the dynamics of this problem.

Concurring to Vygotsky's socio-cultural concept of gathering information, Denhere, Chinyoka and Mambau (2013) argue that a learner is capable of acquiring concepts and language through experience. Denhere et al. (2013) argued that, if mathematical fractions are not taught through an experiential methodology, they will remain abstract and learners will find it extremely difficult to understand such concepts because this type of learning only becomes meaningful in a social context. The researcher further believes that this study can contribute theoretically to developing socio-cognitive theories on learning and, by embarking on this study, the researcher hopes to contribute towards filling a gap in this field especially in Koloti circuit, since

the researcher realised that there was no evidence of similar studies which have been conducted about this field in this specific area. Majority of studies that the researcher has come across and were published around this area are based on school leadership and management.

1.4. PURPOSE OF THE RESEARCH

The research purpose is a statement that indicates the reason for performing an investigation. Therefore, in the sections below, the researcher outlined the aim and the objectives of the research in order to explicitly articulate the purpose of this research study.

1.4.1. Aim of the research

The aim of this research was to explore how fractions are taught to learners in grade 2 at schools in Koloti Circuit at Capricorn District of Limpopo Province, in order to comprehend the difficulties encountered by teachers when teaching fractions to these learners.

1.4.2. Objectives of the research

Since the researcher is having an assumption that grade 2 teachers do encounter challenges when teaching fractions, it is therefore the researcher's intention to investigate those challenges by probing into the following research questions.

- Assess the contextual expertise of grade 2 teachers when teaching fractions.
- Determine which theories are applied in teaching fractions to these learners.
- To establish how fractions are taught to grade 2 learners at schools in Koloti Circuit.

1.5. ROLE OF THEORY

The research focused on the application of both Piaget and Vygotsky's theories to facilitate successful teaching of foundation phase mathematics fractions. According to Piaget, development comes before formal teaching can take place (Blake, 2015; Selepe & Moll, 2016). In order for children to acquire any kind of formal teaching, they must refine inevitable equivalent structures of thought which are chronological in order, namely, the sensory motor, preoperational, concrete operational and formal operational stages (Mensah & Somuah, 2014; Piaget, 1964). In addition, even though the first three psychological factors are all required for development, they are not sufficient to explain how development should take place, until a fourth factor, biological equilibrium in the development of knowledge, is achieved (Selepe & Moll, 2016). Consequently, a minor should be intellectually prepared to access suitable systems of thinking that will assist them to cope with communal ways of grasping knowledge (Selepe & Moll, 2016). The insinuation here is that learning is subservient to growth, given that it is merely made believable by existing structures of thought that are assembled together (Piaget, 1964).

In a learning context, both the circumstances and the teacher, as opposed to the child's growth, enhance teaching (Selepe & Moll, 2016). Consequently, it is the teacher's obligation to provide both learning activities and teaching situations that will give rise to the application of the learner's existing systems of thought, in order for the learner to grasp new content (Selepe & Moll, 2016).

Teachers should ensure that learners are placed in a carefully designed, conducive schooling situation and be left to invent unique perceptions of the sphere (Mensah & Somuah, 2014). They should present learners with appropriately relevant and inclusive introductory materials that facilitate both teaching and learning (Selepe & Moll, 2016). When formulating learning activities, teachers should commence with what the learners can do on their own, formulated from their pre-existing experiences, in order to attach their prevailing experience to the new concepts, with help from their teachers (Siyepu, 2013).

In relation to Piaget, Vygotsky's view of socio-cultural activity is at the core of cognitive development, as people familiarise themselves with, and broaden in some particular communal and racial factors, owing to interactions amongst themselves and their general background (Selepe & Moll, 2016). Socio-cultural theory emphasises that, for actual schooling to take place, the teacher and the learner should have an effect on each other, while, on the other hand, the tasks should afford learners a chance to generate their own understanding during interaction with others (Siyepu, 2013).

Mediation, which is fundamental to Vygotsky's socio-cultural theory of learning, requires that, for proper teaching and learning to prevail; learning activities ought to be properly chosen and configured by significant people in the lives of the learner (Denhere et al., 2013). Furthermore, it is argued that, in a socio-cultural classroom, learners should become energetic participants, while the responsibility of the teacher is to facilitate learning, so that the learners could accomplish meaningful insight regarding the learning material (Siyepu, 2013). Therefore, for effective schooling to take place there should be social cohesion among two or more people with contrasting standards of expertise and mastery of the subject, so that the learner can be pushed to the next level of grasping the learning content (Denhere et al., 2013).

Vygotsky (1978) argued that a child's meaningful understanding of words is generally acquired within a specific context. Moreover, he argued that a deeper understanding of words is highly dependent upon experiencing the actual action of that particular word. The process referred to above take place in the Zone of Proximal Development (ZPD), which is described as the way in which interaction concerning inductive experiential learning of the subject which gives rise to word sense, together with the deductive generalising instruction of the teacher and the curriculum which helps expand understanding of generalised and abstract word meaning could takes place (Vygotsky, 1978). Indeed, learners need to obtain the guidance of skilled people in order to acquire the psychological tools that culture provides (Selepe & Moll, 2016). This will assist the learner to progress into and through the next layer of knowledge or understanding (Denhere et al., 2013).

Teaching mathematics in the child's ZPD is another way of ensuring better performance in this subject (Denhere et al., 2013). Siyepu (2013) revealed that, for ZPD to be implemented successfully, teachers should be well informed in order to equip learners with adequate learning content tasks that they cannot perform independently. The use of ZPD normally closes the gap between whatever a learner can accomplish autonomously and whatever the learner can perform jointly with the teacher (Siyepu, 2013).

Scaffolding, which is another major notion of the ZPD theory, attempts to operationalise the concept of teaching and enhances the social and participatory nature of the schooling process (Denhere et al., 2013). The notion of scaffolding is grounded in the concept that an exercise outside the range or limits of the learner's ZPD can become attainable only if it is attentively constructed (Kaya & Aydin, 2016). Scaffolding does not only justifying the exercise while learning is taking place; scaffolding keeps the exercise unchanged while justifying the learner's part by virtue of the teacher's increased involvement (Greenfield, 1984, p.119).

The research was meant to explore whether grade 2 teachers knew and understood their learners' socio-cultural environment, including their cognitive levels, in order to adjust teaching strategies to suit these learners when teaching fractions. The researcher also explored how successful the teachers are able to employ concrete objects that are accustomed to grade 2 learners when imparting fraction knowledge to them.

1.6. RESEARCH METHODOLOGY

Since the rationale of this research was to explore how fractions are taught to grade 2 learners at schools in the Koloti Circuit, in order to comprehend the setbacks encountered by teachers when communicating fractions to these learners, so the research methodology was conveyed by outlining the following items, namely: research design; population and sampling; data collection techniques and data analysis method which are itemised in the sections below.

1.6.1. Research design

The research was grounded on interpretivist epistemology, where reality is viewed as subjective, differing from person to person (Scotland, 2012). A qualitative research approach was employed during this research. This assisted the researcher to acquire rich detailed narrative descriptions directly from the participants, without any manipulation of the data (McMillan & Schumacher, 2010).

The chosen approach supported the researcher in accomplishing the quest to assess the contextual knowledge of grade 2 teachers in the teaching of fractions; to determine which theories were applied in teaching fractions, and to establish how fractions are taught to these learners. A multisite case study approach was employed and information was gathered from three sites, which provided the researcher with an opportunity to secure an extensive indication of the research problem in order to promote and comprehend it (Baskarada, 2014).

1.6.2. Population and sampling

The research population constituted grade 2 teachers from the selected schools in Koloti Circuit. Participants were sampled from three primary schools, namely; school A, B and C. From each school, one grade 2 teacher participated in the research. Three participants took part in this research.

Purposive sampling was employed in order to allow the researcher to choose the participants based on their day-to-day duties and to locate them with respect to the knowledge they possess (Johnson & Christensen, 2012). Indeed, purposive sampling assisted the researcher to engage with an informative group of participants who were directly involved in the teaching of grade 2 fractions. The researcher further believed that purposive sampling would assist in addressing the objectives of this research with ease.

1.6.3. Data Collection

The researcher applied a pluralistic approach when gathering data to enhance triangulation and enable the merits of the data analysis to maximise the plausibility and honesty in this research (Marishane, 2013). The researcher ensured convergence and corroboration of results by employing various data collection methods (Johnson & Christensen, 2012). Data was collected using document analysis, classroom observations and semi-structured interviews, which were applied in three phases, as indicated below:

Phase 1: Document analysis

The researcher carefully went through and analysed the following documentations that addressed the teaching of fractions in grade 2, namely:

- Foundation Phase Mathematics - Curriculum Assessment Policy Statements (CAPS), work-schedules,
- Grade 2 learner-teacher support materials (LTSMs),
- Lesson plans and learner workbooks
- School records that showed grade 2 mathematics- Subject Improvement Plan (SIP);
- Item analysis reports together with subject diagnostic reports;
- Minutes from grade 2 meetings addressing the teaching of fractions;
- Evidence of parent consultation meetings
- Evidence of class visits;
- Records of monthly written work output;
- Evidence of support programmes given to learners with learning barriers;
- Evidence of catch-up programmes that were conducted;
- Monitoring tools for quality assurance of assessment tasks;
- Teachers' movement registers, together with the teachers' leave registers, which were reviewed and analysed.

Phase 2: Classroom Observations

The researcher conducted classroom observation sessions to accumulate intense perceptions regarding the teaching of fractions to grade 2 learners and the challenges encountered by their teachers when teaching fractions to these learners (Tyilo, 2016). Classroom observations further assisted the researcher to acquire adequate information about the actual behavioural patterns of the participants (Ary, Jacobs, Razavieh & Sorenson, 2014). During classroom observation sessions, the researcher's focus was mainly on the following factors that may hamper proper teaching and learning of fractions partitioning, namely: both learners and teachers' attendance; teacher-learner ratios in the classroom; classroom management; lesson presentations; resources that were employed to teach fractions partitioning, learner participation in the classroom; how learner barriers were addressed; how feedback was provided to the learners and any other relevant documentations that could be suitable for teaching and learning of fractions such as learners' workbooks. Observation schedules were compiled in which the researcher wrote down field notes with respect to verbal and non-verbal behaviours, including participants' attitudes and descriptions regarding the environment during the observation period (Maree, 2012).

Phase 3: Semi-structured interviews

Individual semi-structured interviews were conducted with three grade 2 teachers from the sampled schools. Grade 2 teachers were interviewed because of the direct and pivotal role which they play in the teaching of fractions in their classrooms. Participants were asked the same questions in order to attain data saturation (Fusch & Ness, 2015). The interviews were conducted during working hours and mainly in Sepedi, which is the teachers' mother tongue. The transcripts were later translated into English. The interview sessions lasted for forty-five minutes.

1.6.4. Data analysis

The initial step in the process of data analysis entailed transcribing the raw material, as well as expanding on, and making corrections, where necessary. This initial procedure included the official capturing of observation notes and interview data in order to enable both critical and in-depth analyses.

The second step saw the researcher embark upon the process identified as coding which entailed the organisation of collected information into categories and, thereafter, categorising patterns and instituting relations between the identified categories (McMillan & Schumacher, 2010). Coding and categorisation of raw data were applied to answer the research questions posed (Ngulube, 2015).

Data analysis was conducted separately and independently in order to synthesise logic in the collected data (McMillan & Schumacher, 2010). The researcher employed both formative and summative aspects of data analysis. Ravitch and Carl (2015) argued that, formative data analysis involves the continuous reflection upon the data as it unfolds, while the process of summative analysis materialises after the data has been collected. The researcher conducted data verification after all the data collection was finalised in order to draw the conclusions about this research.

1.7. QUALITY CRITERIA

The following criteria were ensured to make certain that trustworthiness was maintained.

1.7.1. Credibility

The researcher established that the product embodied all conceivable information drawn from the participants' original views by ensuring credibility of the research (Anney, 2014). The following credibility strategies, as presented by Anney (2014), were employed by the researcher to establish quality in this research:

- Prolonged engagement with the research site was maintained in order to grasp the main issues that might have an effect on the quality of the data and promote trust with the participants;
- Multiple research instruments were utilised to ensure data triangulation, namely: document analysis; classroom observations and semi-structured interviews.
- Member checks were ensured by testing data and interpretations continuously, to safeguard any favouritism when analysing and interpreting the results.

1.7.2. Dependability

Dependability refers to the constancy of information over time and under various circumstances (Elo et al., 2014). Audit trails were utilised by the researcher to examine the research process and to validate data when collecting, recording and analysing it, in order to ensure the accountability of all the research outcomes (Anney, 2014). The researcher further used a peer examination strategy to discuss the research process and the findings with her supervisor. This assisted the researcher to be honest about the research (Anney, 2014).

1.7.3. Confirmability

Data and interpretation of the findings were maintained in such a way that they did not show any figments of the researcher's view (Anney, 2014). The researcher ensured that audit trails, reflective journals and triangulation were maintained to demonstrate objectiveness towards the interpretations of other researchers (Thunder & Berry III, 2016).

1.7.4. Transferability

The researcher facilitated transferability by obtaining thick descriptions from, and ensuring purposeful sampling of, the participants (Anney, 2014). Purposive sampling

was employed to assist the researcher to pay attention to, and to select, key participants who were knowledgeable about the teaching of fractions in grade 2. The researcher further explained the research process in full to assist future researchers who may conduct other research under the same conditions in other settings (Anney, 2014).

1.8. ETHICAL CONSIDERATIONS

McMillan and Schumacher (2010) indicated that researchers should have thorough knowledge of their ethical and legal responsibilities about conducting a research. To uphold high research ethical standards that safeguard the human rights of the participants who took part in this research, the researcher was therefore driven by the following principles and guidelines.

1.8.1. Informed consent

The researcher ensured that a permission letter, stating the purpose of conducting the research, was obtained from Turfloop Research Ethics Committee (TREC). The letter was taken to the Capricorn District, Limpopo Province in order to gain access to the schools to be sampled, and which was given to the principals of the schools. Consent letters (**Annexure A**) were given to the grade 2 teachers who served as participants, and the researcher ensured that the purpose of the study was clearly understood by all the participants before they began participating (McMillan & Schumacher, 2010). Consent from participants was obtained by asking them to sign the consent letters which were issued to them before commencement of the research

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1.8.2. Voluntary participation

The participants were informed of their rights to participate in the research, including the right to withdraw their participation at any time during the course of the study without any penalty being imposed on them (McMillan & Schumacher, 2010). The

benefits of participating in this research were also explained so that, participants were not tempted to withdraw their participation during the course of the research (McMillan & Schumacher, 2010).

1.8.3. Privacy and security of participants and data

Since this research dealt with human beings, the names of participants were never disclosed to the public in order to protect their privacy (McMillan & Schumacher, 2010). Strict measures were adhered to when storing the data to ensure that participants were not embarrassed, or that their privacy is invaded at a later stage (McMillan & Schumacher, 2010). During the course of this research, the researcher ensured that access to all the information that was acquired from the participants, including their identity, was restricted to the researcher only (McMillan & Schumacher, 2010). The researcher further ensured that the research findings did not result in any form of physical or mental discomfort, or injury to the participants (McMillan & Schumacher, 2010). This included not divulging information that could result in embarrassment or danger to their home lives, school performance and friendships, as well as direct and harmful results (McMillan & Schumacher, 2010).

1.9. SIGNIFICANCE OF THE STUDY

Proficiency with fractions is regarded as the basis for understanding algebra and becoming more successful with complex mathematics (Fuchs, Schumacher, Long, Namkung, Hamlett, Cirino, & Chngas, 2013). Fractions portrays a valuable function in mathematics since they built an underlying foundation which assists learners to learn topics related to percentages, ratios and decimal numbers successfully (Ndalichako, 2013). They constitute a critical component of mathematics understanding and open doors for many careers that are in demand (Tian & Siegler, 2017).

According to Hurrell (2013), fractions afford teachers an insight into how to develop a learner's understanding of numbers, and relationships between numbers. They furnish learners with important conceptual foundations for the growth and understanding of other number types, and of algebraic thinking (Hurrell, 2013). Furthermore, fractions are also vital for theories of cognitive development, in general and numerical development, in particular (Lortie-Forgues, Tian & Siegler, 2017).

Therefore, the aim of this study was to identify gaps that are prevailing between the challenges that are encountered by teachers when teaching fractions in grade 2 and how the learners are grasping the fraction content (Bajunirwe, Tumwebaze, Abongomera, Akakimpa, Kityo, & Mugenyi, 2016). The researcher, therefore, through the findings of this research, intends to close this gap and provide recommendations to the Department of Education and to grade 2 teachers, including adequate teaching approaches which could enhance learner-performance in fractions; resulting in a higher performance by learners in mathematics at various schools.

1.10. DELIMITATION OF THE STUDY

The study was restricted to the primary schools offering foundation phase in Koloti Circuit of Capricorn District in Limpopo Province. Its focal point was centred on grade 2 classes and teachers, since the study aimed at exploring the teaching of fractions in grade 2, as well as the challenges encountered by teachers when teaching fractions to these learners.

1.11. DEFINITION OF CONCEPTS

The following concepts were used throughout this study, and are therefore defined below:

1.11.1. Mathematics

Mathematics is a branch of science that deals with numbers, quantities and space. Tatira et al. (2012) define mathematics as a body of knowledge that deals with mathematical calculations and dimensions, including mechanisms for the unravelling of obstacles which each person needs to employ in different situations.

1.11.2. Fractions

A fraction is a figure that signifies a part of a whole. Fractions are comprised of a numerator and a denominator. The numerator is a numeral that signifies the quantity of equal parts of a whole, while the denominator is the overall quantity of segments that formulate the articulated whole.

1.11.3. Foundation Phase

Foundation phase is the initial level of prescribed education in South Africa, and it is extremely vital in securing the footing on which learners will build during formal schooling.

1.11.4. Grade

A grade is a class of school learners grouped according to their age and ability.

1.11.5. Learners

Learners are novice pupils who are learning a subject or a skill.

1.11.6. Teacher

A teacher is somebody who supports learners to attain education, capabilities or morals.

1.11.7. Teacher content knowledge

Teacher content knowledge is the incorporation of discipline proficiency into proficient teaching of a particular subject by a teacher.

1.11.8. Contextual knowledge

Contextual knowledge refers to the acquisition of new knowledge by a learner based on that learner's life experiences.

1.11.9. Teaching approaches

Teaching approaches deals with a set of ideologies, theories, or opinions concerning the type of knowledge that is presented to learners in the classroom.

1.12. CHAPTER PRÉCIS

In this chapter, the problem statement was scrutinised and portrayed, and will be elucidated on in subsequent chapters:

Chapter 1: Research orientation

The chapter encompassed the outline and context of the research, wherein the hypothetical justification for the research was dealt with. The episode further acquaints the reader with the crux of the problem which paved the way to the problem statement. The research goal and its intentions are also highlighted in this chapter. In addition, the role of theory and the research methodology, which underpins the research approach, are also highlighted in this chapter. Furthermore, the chapter comprised the quality criteria that were employed during the research. Additionally, the chapter embraced the ethical considerations, significance of the research, delimitation of the research and the definition of concepts that were

commonly used in the research. Chapter précis and conclusion of the research were also dealt with.

Chapter 2: Literature review

The chapter presents a review of the collected works that was employed to reinforce the hypothetical basis for the research. The following issues were reviewed, namely; the approach to fractions teaching as a worldwide challenge, fallacies concerning the imparting of fractions knowledge, the importance of teaching fractions at foundation phase level, approaches to fractions teaching, mathematics teacher content knowledge in South African schools and challenges faced by teachers when teaching fractions.

Chapter 3: Research methodology

The chapter presents a comprehensive outline of the research design, population and sampling, data collection techniques and data analysis methods. Quality criteria, ethical considerations, significance and delimitation pertaining to the study are also discussed in this chapter.

Chapter 4: Data presentation, analysis and research findings

The chapter offers a far-reaching narrative report of the participants' reactions with regard to challenges encountered by teachers when teaching fractions to grade 2 learners at schools in the Koloti Circuit. The presentation and analysis of findings focuses mainly on the six themes that turned up during the data analysis process as outlined in this chapter.

Chapter 5: Summary, recommendations and conclusions

The chapter presents the introduction, research design and method, including a summary of the research findings, wherein the well-defined interpretation that justified the outcomes of the research inquiry solely for creation of bonds between the testaments acquired from the participants and the prevailing knowledge are presented. Lastly, the recommendations emanating from the research are presented in this chapter, since the aim of this research was to explore how fractions are taught

to learners in grade 2 at schools in the Koloti Circuit, in order to understand the challenges encountered by teachers when teaching fractions to these learners.

1.13. CONCLUSION

This chapter set out the preamble to the study, the background, problem awareness, problem statement, research goal, and the research intentions. The role of theory was also highlighted in this chapter. The chapter further explored the research methodology, research layout including the population and data sampling in the research. The data collection methods, namely; document analysis, semi-structured interviews and observations, were also highlighted. Quality criteria, ethical considerations, significance of the study, delimitation of the research and definition of concepts were also discussed. The chapter concluded with a chapter précis. The following chapter will deal with the literature review, which will reinforce the hypothetical basis underpinning the research.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

In order for South African teachers to overcome the challenges encountered by teachers when teaching fractions to learners in grade 2, similar literature related to the problem was studied. The following objectives were outlined in the previous chapter, namely: to assess the contextual knowledge of grade 2 teachers in the teaching of fractions, to determine which theories were successfully applied to the teaching fractions to these learners, and also to establish how fractions were taught to grade 2 learners at schools in the Koloti Circuit, Capricorn District, Limpopo Province. The aforementioned objectives were singled out in order for the researcher to arrive at possible recommendations that could benefit grade 2 teachers in their efforts to overcome the challenges they are faced with when teaching fractions to their learners.

The motive for this chapter is to reflect on what other researchers are saying about the teaching of fractions as a worldwide challenge, fallacies concerning the imparting of a knowledge of fractions to learners, the importance of teaching fractions at foundation phase level, approaches to the teaching of fractions, mathematics teacher content knowledge in South African schools, and teacher challenges in the teaching of fractions

2.2. FRACTIONS TEACHING AS A UNIVERSAL PROBLEM

The rationale of this section in relation to this study is that, fractions knowledge embodies a learner's elementary significant venture into conceptual mathematics, and that fractions knowledge not only permits learners to perform operations but also bestows them with a base to thrive with rates, percentages, slope, and various other topics in secondary school mathematics (Son & Senk, 2010).

Mathematics teaching and learning has always been a complicated task and it appears that success is not easy to achieve at both international and national levels (Maboya, 2014). Siyepu (2013) highlighted that, worldwide studies divulged that, there is a serious concern about the low quality of results obtained by learners in mathematics, yet most of the investigations that were conducted revealed that the knowledge of the subject matter that South African learners possess is inconclusive. The cause appears to be linked to an insufficient practical mathematics vocabulary (Siyepu, 2013).

The work of a number of researchers (Booth & Newton, 2012; Clarke, 2006; Lortie-Forgues et al., 2015; Ma, 1999; Torbeyns, Schneider, Xin & Siegler, 2015) revealed that encountering hurdles with fractions is familiar, even amongst potential teachers from diverse countries, yet it is comprehensible that studies on learners' challenges with fractions have been a continuous action. Local and international research has demonstrated that the problem is caused by teachers who show poor conceptual comprehension of fraction arithmetic (Lin et al., 2013).

Research has revealed that educating and acquiring fraction concepts causes serious problems in primary schools all over the world (Lin et al., 2013). Fractions have been shown to be a subject of remarkable and unchanging difficulty, both in its administration and in acquiring the requisite knowledge (Yearly & Bruce, 2014). Fazio and Siegler (2011) revealed that learners around the world encounter challenges when learn fractions, resulting in these learners being unable to gain conceptual knowledge of fractions as expected.

The National Council of Teachers of Mathematics (NCTM) report revealed that the results of the federal tests, which were administered in America, show that, at most, half of the eighth graders were able to sequence three fractions, starting from the smallest to the largest (Martin, Strutchens & Elliott, 2007). Fazio and Siegler (2011) further revealed that, in various countries, such as Japan and China where most of the learners are considered to attain a sensibly exceptional conceptual understanding, fractions are regarded as a challenging subject.

Ndalichako (2013) also showed that Tanzanian teachers and researchers concur with each other that majority of learners experience remarkable challenges regarding the learning of fractions. Ndalichako (2013) argued that, this is likely to be one of the most severe barriers to the mathematical development of learners, since learning fractions constitutes an important portion of primary school mathematics teaching content, which is introduced as early as grade 1.

Moss and Case (1999) revealed that potential grounds for such challenges incorporates the reality that there are numerous maxims that are equated with the calculation of fractions, which are more complicated than those of natural numbers. As a result, teachers dedicate a great deal of their time to showing learners how to work out fractions, and spend less time on their conceptual implications, yet this hampers the learners' ability to keep an eye on their work (Moss & Case, 1999). Consequently, teachers tend to examine the learners' responses by repeating the rote approach only, while failing to assess the credibility of the learners' responses, because they are too certain with their approaches (Moss & Case, 1999).

Hoxha and Vula (2014) highlighted that, mathematics teachers rank the learners' understanding of fractions at a very low level because it was discovered that a major challenge that learners are confronted with, in order to comprehend fractions, is that they do not regard fractions as numbers. Instead learners pay attention to the gist of numerator and denominator as detached numbers rather than as a single number (Hoxha & Vula, 2014). As a result, learners commit to memorise the terms numerator, denominator and fractional line, forgetting to comprehend the whole concept of a fraction (Hoxha & Vula, 2014).

Bruce et al. (2013) indicated that it was discovered in mathematics education literature that learners in North American schools experience challenges in understanding fractions, which results in a difficulty to grasp the concept. The authors indicated that this is displayed on the American continent, particularly in Chile, where mathematics achievement among learners is dismal (Bruce et al., 2013). Furthermore, within the North American education system, fraction learning is often focused on one "type" of fraction, namely that which represents a part-whole relationship, and this singular interpretation, along with an overuse of proper

fractions, prohibits learners from deeply understanding fractions greater than one (Bruce et al., 2013, p. 8).

In North American classroom instruction, fractions are determined as selectively part-whole correlations which restrict the learners' comprehension of a fraction as a quantity, resulting in numerous and constant false impressions (Lamon, 2001; Smith, 2002; Thompson & Saldanha, 2003). Learners regard fractions as an extensive challenge that they strive to construct comprehension of, and work with improper fractions due to the remarkable explanation of fractions as part-whole interpretations (Charalambous & Pitta-Pantazi, 2005 & Watanabe, 2006).

2.3. MISCONCEPTIONS ABOUT FRACTIONS TEACHING

The researcher found it beneficial to review literature on the misconceptions about fractions teaching in order to establish the fallacies that normally prevails in the background about the teaching and learning of fractions. Since this study deals with the challenges that are encountered by teachers when teaching fractions in grade 2, the researcher deemed it suitable to establish any fallacies that may be available that might be contributing to the challenges that are encountered by teachers when teaching fractions in particular. Below are the fallacies that other researchers revealed on fractions teachings.

Nesher (1987) defined misconceptions about fractions teaching as a manifestation of a structure of ideas and a set of rules used in calculations that have already been gained by learners and were incorrectly utilised. Ojose (2015) argued that misconceptions are false impressions that are formed as a result of inaccurate interpretations owing to innocent opinions that hinder the learner's logical reasoning. A misconception is an outcome of the absence of proper comprehension or from the misuse of mathematical statutes, including generalization (Spooner, 2012). According to Mohyuddin and Khalil (2016), the 1987 International Commission for the Study and Improvement of Mathematics Teaching (CIEAEM) revealed that a

misconception is derived when an individual decides to choose the fictitious statement as real.

According to (Bailey et al., 2015 & Torbeyns et al., 2015), problems with mathematics may start prematurely in the educational system. Coetzee and Mannen, (2017) further revealed that mathematics difficulties can be traced back to primary school mathematics, especially to the studying and educating of fractions concepts. Research by Sarwadi and Shahrill (2014) uncovered the fact that, since mathematics learning is cumulative due to the grasping of the new learning which is only acquired when it is connected to prior learning, mathematics learning is an on-going activity that requires vigorous learner engagement, which will have direct effect on what learners learn.

Sarwadi and Shahrill (2014) further argued that, if a learner is incapable of taking in and understanding new knowledge, the repercussions, thereof, generate an imbalance in the learning of the concept, resulting in mathematical errors and misconceptions. Spaul and Kotze (2015) defined the above structure as the ranking of cognition and mental dexterity. Worldwide consensus among researchers reveals that learners do not come into the classroom as bare slates, based on the information and awareness gained through experiences, which shapes their new learning, as they build new concepts from prior knowledge (Resnick, 1983). Learners normally bring their insights, opinions and ideas about the sphere into the classroom (Murphy & Alexander, 2004). They come with concepts that are formulated from their daily interactions; however, some of the interactions that learners draw on to make sense of the world are fragmentary half-truths which may be called misconceptions (Mohyuddin & Khalil, 2016).

Gould, Outhred and Mitchelmore (2006), in their research undertaken with the purpose of understanding the learners' rationality and misconceptions associated with fractions, revealed that learners consider fractions as parts of the sets rather than parts of the whole. It is, therefore, considered truthful that the way in which knowledge is conferred can shape one's way of understanding (Ausubel, 1963). As a result, Ojose (2015) argued that it is imperative for teachers to quickly detect and

acknowledge that learners appear in their classrooms with misinterpretations and misconceptions. Therefore, it is crucial that teachers assign themselves the responsibility to work in the direction of discovering the prevailing misconceptions among learners through proper planning, being willing to provide these learners with opportunities to learn through effective teaching strategies in order to assist them to progress from one grade to another without these detrimental misconceptions. Therefore, for teachers to provide learning concepts with high quality, it is vital that they acquaint themselves with the learners' prior knowledge and ensure that new strategies that are relevant are implemented (Akdeniz, Bektaş & Yiğit, 2000).

Since learners' errors and misconceptions are common in algebra, the situation is, therefore, spread among a large number of people who find that mathematics is baffling. This causes most of these people to believe that the subject is not for each and every one but for certain individuals only (Khanyile, 2016). Consequently, both foundation and middle school learners assumed that $\frac{1}{4}$ is more than $\frac{1}{2}$ for the mere fact that 4 is bigger than 2 (Ojose, 2015). In addition, learner gaps and misconceptions are strongly exposed in their portrayed representations of fractions. Various studies have confirmed that the variety of representations employed do not assist learners in constructing profound fraction comprehension (Mathematics Learning Study Committee, 2001 & National Research Council, 2001).

Ay (2017) highlighted that misconceptions come forth as a consequence of occurrences and incorrect opinions of individuals, where every person has their own distinctive thinking system which is employed to construct common-sense in order to convey the world. Mestre (1987) further revealed that, if these reasoning structures are defective, they become the foundations of misconceptions. Luneta and Makonye (2010) argued that errors and misconceptions may show a connection to one another but they are not the same thing. Luneta and Makonye (2010) established two sets of errors namely: systematic and unsystematic errors. Lukhele, Murray and Olivier (1999) postulated that unsystematic errors are not displayed deliberately by learners; pointing out that learners may not reiterate such errors instead they can rectify these errors unaided. Systematic errors may be reiterated, systematically

formulated, or reformulated over a period of time, due to comprehension of inappropriate ideas about working out a specific obstacle (Idris, 2011).

Eryilmaz (2002) revealed that, since most of the learners cannot differentiate between misconception and error, it is the sole responsibility of teachers to pay more attention to dealing with misconceptions which represent the origin of errors. Murphy and Alexander (2004) highlighted that, if any misconceptions prevail in the preceding theories, it is extremely likely that exposure to new theories will also incorporate misconceptions. Driver and Easley (1978) also stated that misconceptions are revealed when learners convey their insights, ideas and opinions regarding the world inside of the classroom situation.

It is, therefore, important for teachers to pay attention to, and become familiar with, the likely causes that stand behind these misconceptions, which are the origin of errors, and safeguard against them, in order to develop systematic teaching milieu (Ojose, 2015 & Eryilmaz, 2002). Consequently, establishing and eradicating learners' misconceptions assists teachers to comprehend the learners' social circumstances and insights of an intellectual concern and, therefore, configure their modus operandi in teaching (Ay, 2017).

2.4. THE IMPORTANCE OF TEACHING FRACTIONS IN FOUNDATION PHASE

The researcher in this study decided to have a glance at the literature relating to the importance of teaching fractions at foundation phase level in order to have a view of how important proper fractions teaching is valuable to learners in the foundation phase since the researchers assumes that teachers are the ones who are encountering challenges in teaching fractions to these learners. The literature below clarifies the importance of teaching fractions at foundation phase level.

Spontaneous reminisce of maths facts is absolutely an important factor for learners to draw on to be able to construct mathematical calculations, both in the current and subsequent periods of their schooling career, in order for them to be drawn towards mathematics triumph (Renaissance Learning, Inc., 2015).

Hurrell (2013) indicated that many teachers do not administer fraction lessons for instant employment and comprehension, but they are implemented preferably as a useful foundation to facilitate studying and as scaffolding for vital conceptual frameworks. Recent research findings revealed that fractions and decimals act as permanent essential parts in numeral evolution because, if both the basic theories and comprehension of fractions are not dealt with successfully, the preliminary work for further operations regarding fractions and fractions ideas will not exist (Bruce, Bennett & Flynn, 2014; Lortie-Forgues et al., 2015).

Ndalichako (2013) argued that fractions play a major part in mathematics learning due to their academic value, as they formulate the substructure which assists learners to grasp and master mathematical themes such as percentage, ratios and decimal numbers with ease. Mathematics is one of the disciplines that is arranged in a formally graded order (Ndalichako, 2013). Spaul and Kotze (2015) argued that, the progression of more and more complicated cognitive mathematical expertise at each stage relies on the development and the accruing of proficiency with respect to its conceptual structures. This can result in a considerable number of obstacles with mathematics being detected back to elementary school mathematics, and, in particular, to the learning and teaching of fractions (Spaul & Kotze, 2015).

Vitoria, Fauzi and Ananda (2017) highlighted that, the implementation of fractional theory is detectable in our everyday life as fractions are employed in discussions regarding distances and ages, and in the measurements of length, weight, and volume. Acquaintance with fractions is important as it helps in both the comprehending of algebraic skills and mathematics attainment by learners at high school level (Booth, Newton, & Twiss-Garrity, 2014; Coetzee & Mannen, 2016; Siegler et al., 2010). Furthermore, fractions are encountered in algebra and are, therefore, crucial in order for one to accomplish success in algebra and to perform well in mathematics-related courses (Booth & Newton, 2012; Siegler, Fazio, Bailey & Zhou, 2012; Watts, Duncan, Siegler & Davis-Kean, 2014). As a result, knowledge of fractions indirectly determines career choices and eventual income levels (Titus, 1995). Bezuk and Cramer (1989) emphasised that the principal motive of primary fraction-theory activities is to present learners with background knowledge that will

enable them to develop the powerful intellectual representations of fractions that form the bedrock for quantitative intellect.

2.5. FRACTIONS TEACHING APPROACHES

The researcher in this study decided review literature on fractions teaching approaches in order to gain knowledge about the teaching approaches that are normally used when teaching fractions, and therefore assist in curbing the challenges that are assumed to be encountered by teachers when teaching fractions in grade 2 as alluded in the problem statement above . The literature below clarifies the teaching approaches that are normally employed when teaching mathematics starting from the foundation phase.

Long and Dunne (2014) highlighted that, when curriculum resolutions are made about mathematical theories, the command of mathematics suitable to the phase, the approach of teaching mathematics, and the future evaluation of learners in mathematics are also considered .

Fazio and Siegler (2011) emphasized the fact that learners should be presented with fractions at a premature age by building on their existing prior knowledge about sharing proportionally. Teachers should start with straightforward splitting actions that incorporate sharing a set of objects equivalently between groups of recipients without any remainder safeguarding that, as the learner's knowledge develops, both the number of objects to be shared and the number of recipients can be increased (Fazio & Siegler, 2011). In addition, Fazio and Siegler (2011) further argued that teachers should present fractions problems in actual situations, using reasonable numbers, as it would be more advantageous to learners to have to solve fraction problems in a meaningful real-life context. Consequently, providing real-life contexts, such as food, drink and time, and measurement tools, such as watches and rulers, inspire learners to employ their innate problem-solving strategies, instead of depending on memorized procedures (Fazio & Siegler, 2011). Wood and Millichamp (2000) further suggested that in order for actual learner academic performance to

take place it is necessary for teachers to ensure that more learner participation is taking place in the classroom.

Hatch (2016) argued that a further procedure that teachers should employ to attain insight perception into the learners' comprehension is the use of mathematical tasks, since these tasks are regarded as the pillar of learners' work in mathematics teaching moreover that, undertaking tasks that promote expertise in fractions, results in substantial value in the mathematics classroom.

Drews and Hansen (2007) indicated that teachers should employ various mathematical games in order to integrate knowledge and skills gained by learners through studying, scrutinising mathematical correlations and expanding problem-solving game plans. These games can be performed in whole-class, small group or paired settings since they are generally highly motivational to learners, resulting in considerable levels of attentiveness and involvement with mathematics (Drews & Hansen, 2007).

The National Numeracy Strategy (NNS) encourages the usage of an extensive variety of information and communication technology (ICT), which are available in many of the primary schools as valuable assets and tools to support the imparting and acquiring of mathematics (DfEE, 1999). According to (Bottle, 2005 & Chen, 2010) it is proposed that, there must be a correlation between the assignments embarked upon when applying ICTs and mathematical activities free of the gadget, bearing in mind that gadgets by themselves do not teach and they have to be wisely and commendably employed by the teachers to aid in the learning process. Thompson and Thompson (2010) also endorsed the fact that supplementary unequivocal relationships must be formulated between computer activities and projected activities, so that learners can acquire a deep understanding of mathematical relations.

Mahlo (2017) argued that it is only during foundation phase that learning should be laid-out meritoriously to learners in order to elevate their interest and positive attitudes towards schooling because if a child fails at this stage, he or she will be adversely affected and may even drop out of the schooling system before having had an opportunity to explore his or her learning potential. Therefore, it is vital that

teachers should be well-informed about their learners' challenges with fractions in order for them to modify their teaching to suit the learners' existing competency levels (Torbeyns et al., 2015). Moreover, it is a prerequisite when choosing resources that a teacher should be intent on the employment of a specific resource and should be certain about the scaffold it can provide to learners (Torbeyns et al., 2015). Therefore, variety is imperative in selecting properties to scaffold a learner's erudition to safeguard them from constructing incorrect sweeping statements if they are given inadequate illustrations (Drew & Hansen, 2007). It was for that reason that learners are provided with, and talked to about, illustrations and non-illustrations, so that they could probe appropriate and inappropriate attributes (Askew & William, 1995).

Moyer (2001) highlighted that, it is pivotal to utilise teaching resources in mathematics education in order to offer learners more interest in the subject. Delaney (2003) also revealed that, utilisation of teaching resources in mathematics is a paramount approach and can precede the circumstances in which both the teacher and learner are obscured as to how such resources are valuable to mathematical learning. Similarly, sensible objects are not at all beneficial if the learners seized to abstract the intellectual arithmetic from the experience' and that teachers ought to be distinct about the utilisation of certain resources (Drew & Hansen, 2007 & Askew, 1998). The defect of over-reliance on a demonstration approach is that, if a resource is barely ever exercised to establish how to perform something, teachers would barely realise from the learner's acts whether they comprehended the instructions that are presented to them or not (Delaney, 2003). Therefore, portion of the verdicts rotate about whether resources are more helpful when employed by teachers' illustrations or applied by learners to connect with numerical philosophies (Delaney, 2003)

2.6. MATHEMATICS TEACHER CONTENT KNOWLEDGE IN SA SCHOOLS

The researcher in this study opted to review literature on mathematics teacher content knowledge in SA schools in order to review the level of mathematics teacher content since this study assumes to explore the challenges encountered by teachers

when teaching fractions in grade 2. The literature below assisted the researcher to achieve the research objectives in the sense that it clarifies the level of teacher content knowledge needed in order to excel in teaching mathematics.

Foundation phase teachers demand a concrete perception of mathematics so that they can teach it as a comprehensible, systematic activity and communicate its sophistication and sovereignty, and one of the imperative areas of potential teachers' knowledge of fractions is to have a deep understanding of all of the diverse interpretations of fractions (Olanoff, Lo, & Tobias, 2014).

Human et al. (2015) defined algebraic awareness aimed at instruction as the command that a teacher employs when tutoring mathematics as a subject in which two fields are incorporated, namely; the topic awareness and the instructive awareness. The topic awareness field is classified into customary subject awareness and instructive awareness. Subject awareness is utilised by human beings in their everyday lives, their proficiency to realise if a learner's response is right or wrong and the reasons thereof, together with their ability to comprehend the definition of mathematical concepts (Human et al., 2015). Instructive awareness comprises of three categories, namely: awareness of the subject as well as the learners; awareness of the subject and instruction, and the awareness of the programme of study (Human et al., 2015).

In relation to the above, it was highlighted in various studies that, it is not sufficient to emphasise only the realisation of the subject matter in the training of teachers (Wilson, Floden & Ferrini-Mundy, 2001). Hence it was acknowledged that the realisation of the subject matter together with that of the instructional content are of paramount importance when dealing with the training of teachers (DBE & DHET, 2011; Human, van der Walt & Posthuma, 2015; Wilson, Floden & Ferrini-Mundy, 2001). Human et al. (2015) argued that, the general subject matter knowledge that teachers who are still training need to possess includes, among others, the following: the relationships between operations; the undertaking of computations using properties of accumulation and proliferation; the interpretation of the results of computations; embarking on computations easily; the application of negative numerals in computations and the application of brackets.

Specialised content knowledge incorporates the utilisation of demonstrations, the correlation between symbols and picture representations and the way in which a mathematical explanation is given, including the way in which different answers to conundrums are furnished (Human et al., 2015). Correspondingly, Human et al. (2015) contended that, the acquaintance of content and that of learners refers to the skill that the teacher has to acquire in relation to the normal errors that are committed by the learners and the way in which learners of a particular age formulate their cognition. On the contrary, knowledge of content and teaching deals with the pattern in which the teacher presents abstract theories to learners of a particular age group (Human et al., 2015).

Chikiwa, (2017) defined pedagogy as concepts and teaching strategies, such as arrangement of time, space and text, that are utilised by a teacher in the classroom to enable successful teaching and learning in a manner which contemplates both the knowledge arrangement and its dissemination. Therefore, a universal understanding, grounded in the above definitions, is the fact that most teachers lack 'mathematical knowledge' in the sense that mathematics teaching in South Africa is, to some extent, very disheartening (Long & Dunne, 2014). Large number of South African teachers does not have a passable foundation with respect to the subject knowledge required in order to present their learners with the basic concepts of the study, hence their low assessment practices in mathematics (Brown, Wilmot & Ash, 2015; Venkat & Spaul, 2015). Therefore, education cronies contemplate teacher quality as the most significant determining factor of learner performance (Sheperd, 2013).

One of the main concerns in the training of teachers is how to improve the capacity and competency of student teachers to safeguard the education system in our schools (DBE & DHET, 2011). The prerequisite for intermediation in foundation phase training was long characterised by, among other things, the following:

- The inadequate performance of grade 3 learners in the 2010 ANAs, where they recorded an average mark of 28% for numeracy (DBE, 2011; Graven & Venkat, 2014);

- The information that teachers often commit similar errors as those committed by their learners (Ryan & Williams, 2007); and
- Student teachers exhibiting a gap in their mathematical knowledge when they register for further study, because they ceased taking mathematical subjects after the age of 16 years (Goulding, Rowland & Barber, 2002).

Siyepu (2013) also indicated that, in most cases, teacher quality affects learner outcomes in South Africa due to their lack conceptual knowledge, which is under par; their lack of understanding of the subjects they are offering; and the commitment of high level of mistakes in the content and concepts that they present during lessons; which results in learners who underachieve. Spaul (2013) further revealed that the Centre for Development and Enterprise, South Africa (CDE) report encountered three difficult tasks that are acknowledged and justified by both DBE and DHET (2011), namely, that there is both a scarcity of teachers, and a proportionate scarcity of certified teachers who are capable of teaching particular subjects (including mathematics) in particular phases, such as the foundation phase in African languages.

Local sources and academics also revealed that, mathematics teachers at primary schools possess insubstantial amount of abstract and instructional content knowledge (Spaul, 2013). However, these teachers with a poor grasp of fundamental concepts deprive learners of higher-order tasks and contribute to low levels of learner achievement (Pausigere, 2014). Furthermore, the 2007 Southern and Eastern African Consortium for Monitoring Educational Quality III (SACMEQ) revealed that majority of South African mathematics teachers have inadequate foundation levels of content knowledge, with large numbers of teachers not being capable of answering the questions that are targeted at their learners (Spaul, 2013). According to Venkat and Spaul (2015), teacher education colleges were merged into higher education institutions, resulting in the situation that graduates from these disadvantaged colleges, lacking in mathematics content knowledge, still populate the majority of South African schools. These teachers work closely alongside teachers who graduated after the inception of the democratically elected government (Venkat & Spaul, 2015). As a result, the number of capable, qualified teachers who are

skilled to administer all school subjects in all phases is insufficient (Hofmeyr & Draper, 2015). Furthermore, the repercussions of out-dated teaching practices, together with the absence of foundational content knowledge, results in poor teaching standards (Hofmeyr & Draper, 2015). This state of affairs is exacerbated by a substantial number of teachers without the necessary qualifications; yet they teach in overcrowded and non-equipped classrooms (Siyepu, 2013).

Mathematics teacher content knowledge in South African schools is not sufficient for constructive classroom practice, resulting in poor learner performance (Morrison, 2013). Additionally, Venkat and Spaul (2015) revealed that the lack of the subjects' conceptual knowledge among teachers is the underlying cause of the limitation on the virtue of teaching and learning activities, which manifests in poor performance by the learners. Birman, Desimone, Porter and Garet (2000) further argued that in order for teachers to reach to recent standards and incorporate multifaceted thinking skills, it is crucial that they possess a high-level understanding of the content and of how learners learn that content.

Taylor and Vinjevold (1999) made the deduction that substandard conceptual knowledge among teachers of the subjects they are teaching is the underlying cause of the limitation of the standard of teaching and learning activities, which impacts negatively on the value of the end results of learning. Brown et al. (2015) further articulated that teachers are essential role-players in accomplishing excellence in education, due to their pivotal role in imparting content knowledge to learners. Therefore, the content knowledge and pedagogical content knowledge of South African teacher have to be reinforced in order to assist learners to grasp the subject matter (Brown et al., 2015). Moreover a teacher's mastery of what to teach and how to teach has a huge impact on learner attainment, which will influence the standard of learning in schools (Chikiwa, 2017). In addition, worldwide studies revealed that teachers are the major agents of change with regard to learner performance in schools (Mourshed & Barber, 2007). Consequently, teacher attributes should remain the most significant element when striving for advanced learner performance; since teacher attributes are related to effective teaching, as determined by the results learners achieve (Strong, 2011).

Therefore, it is a prerequisite for teachers to be well trained, get highly motivated; become devoted to their work and be professionally competent if efficient application of the curriculum is to be guaranteed (Meerah et al., 2010). Fazio and Siegler, (2011) further highlighted the fact that, in order for teachers to impart fractions lessons adequately, they ought to have in-depth insights with regard to fraction concepts and operations, since it has been discovered by analysts that math attainment by learners is dependent on the mathematical knowledge of their teachers. Furthermore, since most of the teachers are unable to inculcate relevant knowledge to our learners, these pronouncements have terrible repercussions for the worthiness of South African education system as a whole (Spaull, 2013). Therefore, both the content knowledge and the pedagogical content knowledge of mathematics teachers in poor and rural areas has to be enriched, otherwise it will be remarkably challenging to upgrade the standard of learner attainment in mathematics (Spaull, 2013).

Consequently, for South Africa to accomplish educational growth, the country requires an influential and established education system that fosters good teaching and that entices and retains the best teachers by embracing teacher reimbursements, financial support packages and other interventions aimed at teachers who are in the system (Van der Berg, Taylor, Gustafsson, Spaull & Armstrong, 2011).

2.7. TEACHER CHALLENGES IN THE TEACHING OF FRACTIONS

The position of this study with regard to this section is to review the factors that lead to the challenges that are experienced by mathematics teachers when teaching mathematics since most of the learners do not perform adequately in fractions in order to relate them with what is encountered by grade 2 teachers in Koloti circuit. The researcher in this study therefore revealed the following literature concerning teacher challenges in the teaching of fractions.

According to (Fleisch, 2008; Moalosi & Molwane, 2010) it was highlighted that, the fact that current research into the application of the national curriculum in rural

primary schools with foundation phase has found that teachers encounter various challenges concerning teaching and learning of fractions, both globally and countrywide. These challenges originate from the absence of efficient teaching and learning in both mathematics and literacy in the foundation phase (Abdullah, Mokhtar, Halim, Ali, Tahir & Kohar, 2017).

Pausigere (2014) revealed that, mathematics literature that was publicised post 1994 about South African primary mathematics spells out that, the nature of primary mathematics is in calamity. Furthermore, investigations portrayed that the notion of opportunity to learn (OTL), which refers to time, coverage, sequencing and pacing of curriculum content including fractions which is administered to learners is a serious challenge (Taylor, Draper, Muller & Sithole, 2013). OTL notion shows that primary mathematics teachers in the higher grades teach content, skills and concepts that were supposed to have been addressed in the lower grades (Taylor et al., 2013). The researcher revealed from the above literature that foundation phase teachers have a challenge of not covering the content, skills and concepts that were supposed to have been addressed in the lower grades.

Taylor (2011) divulged that the National Science Education Standards (NSES) reports, together with the National Education Evaluation and Development Unit (NEEDU) reports revealed that, there is no resource which is more negatively exploited in South African schools than time. Substantial learning time is wasted through learner and teacher late-coming, not attending classes punctually after break, not attending classes at all, not maintaining learning activities during class, and leaving the school during school hours for training, union meetings, funerals and commemorative services (Taylor, 2011). Erden (2010) has also indicated the usage of inappropriate teaching methods and inadequate subject knowledge of the teachers as contributing factors to poor quality teaching and learning in our schools.

Strother, Brendefur, Thiede and Appleton (2016) revealed that fractions' teaching is a remarkably incomprehensible task for countless teachers and learners because of the fundamental hassle with regard to the subject matter and insufficient availability of high quality contemporary curricular information. Bruce et al. (2013) contended that, the problems encountered when giving lessons on fractions are aligned to, and

partially covered by many of the challenges encountered when learning fractions. The following factors are indicative of the universal challenges related to fractions teaching, namely: the use of fractions cannot be prevented in one's everyday life, but instead they are concealed in contexts that learners do not identify them as fractions situations; the system in which fractions are written is quite complex and there are a number of statutes that are linked with fractions mechanisms, and these statutes are more complicated than those of natural numbers (Bruce et al., 2013).

International research revealed that, valuable learning time in the classroom is positively associated with the degree of learner attainment. A reduction in learning time means that the ability to cover the entire curriculum is questionable and, consequently, learner attainment will deteriorate (Scheerens, 2004). Additionally, Taylor et al. (2013) argued that time management is a notable problem in most South African schools and that school and class attendance is a serious concern, this result in reduced classroom learning time for South African learners, and the aggregate time that mathematics is taught is, in reality, very low throughout a year. This results in a considerable number of primary teachers opting not to cover the more advanced topics. Furthermore, the South African schooling system is characterised by enormous imbalances of both human resources and educational materials, which are unevenly spread across various social and economic groups (Pausigere, 2014).

Ndalichako (2013) argued that fractions are one of the most challenging concepts taught to learners during their years of primary education. Research by Askew, Venkat and Matthews (2012), revealed that primary mathematics lessons are substandard, unclear and erratic, which impede comprehension of, and constructing sense out of, mathematics by learners. The problem was exacerbated by the scrapping of the federal cumulative syllabus of study that stipulated the step-by-step content to be taught which occurred prematurely during the post-apartheid years, (Fleisch, 2008; Schollar, 2008; Taylor, 2011; Taylor & Vinjevold, 1999; Thakrar, Wolfenden & Zinn, 2009).

The teaching and learning of fractions are the most challenging concepts in mathematics because they run parallel to and overlap with each other (Bruce et al.,

2013, p.18). The style in which fractions are jotted down is complicated and, consequently, they are not associated in everyday life; instead, they are concealed in milieus that learners do not easily distinguish as fractions situations. In addition, there are countless rules related to the system of fractions, which are more composite than those applying to ordinary figures (Bruce et al., 2013). Indeed, countless practices that correspond with fractions systems are available. These practices are more complicated than those of natural numbers (Bruce et al., 2013, p18). South Africa has pioneered an on-going school mathematics curriculum in this sphere, yet the difficult task facing the country is the expertise to apply it (Phakeng, 2015, p 1).

Gould et al. (2006) and Bruce et al. (2013) revealed that spherical depictions are challenging since dividing round shapes equivalently is more problematic for peculiar or large numerals. This causes learners to focus more on the number of compartments and less on the equivalency of the compartments, resulting in learners becoming confused about whether compartments must be equivalent or not. Simon (2002) argued that when learners do not grasp the equivalency of portions of similar numbers that have been divided in two equal parts, signifies the grasping of fractions as an assembly instead of a quantity. Therefore, Bruce et al. (2013) accentuated the fact that insufficient foundation in fractions usually minimises the learners' ability and zeal to do mathematics at a high level.

Multi-grade education is considered as the norm for the majority of rural societies and comprises a change from teacher support to group support, peer support and finally to individual self-directed learning (Mulryan-Kyne 2007). On the other hand, far from being a hindrance to learning, the system of multi-grade teaching may add value when coming to the enhancement of writing in rural communities (Condy & Blease, 2014). Little (2005) indicated that multi-grade classrooms are valuable as teachers assist learners and learners assist one another with regard to their personal self-determining learning. Consequently the companionship patterns of learners, their self-confidence and intellectual and societal advancement become evident in schools characterised by multi-grade classrooms.

Taylor (2008) also testified that, regardless of the rudeness and prejudice from the public view with regard to multi-grade teaching, South African teachers are

committed to and perform rigorously when teaching learners under challenging conditions. In addition, Beukes (2006) identified several obstacles encountered by rural multi-grade teachers, namely: the non-existence of well-defined supervision of learners in multi-grade classes; unpredictable learner attendance at school; absence of proper classroom management skills; mother tongue influences; learner grouping; and time management.

Vithanapathirana (2010) also revealed that there are countless problems with regard to multi-grade teaching, namely: excessive teacher absenteeism; the number of teachers employed being fewer than the number of teachers teaching; minimal learner enrolment; and parents preferring to send off their children to nearby, more affluent schools, resulting in a decrease in the number of learners registering in rural multi-grade schools. Brown and Gordon (2009) alluded to the fact that planning is an eminent guide to one's day-to-day actions and responsibilities, and to assist the teacher in deciding the objectives which comprise the aims of the subject matter to be attained, abilities to be established, teaching approaches, assessment, timeframes and the type of learner that teachers have to develop. The National Curriculum Review (NCR) also revealed that, teachers indicated that, the prerequisites for planning happen to turn out to be haphazardly problematic, and emerged to create slight impact to improving teaching and learning (DBE, 2009). Furthermore, Nsamba (2009) revealed that there is no appropriate planning of lessons and that, even if teachers are familiar with the steps that need to be followed when planning; they consider planning to be a complicated mission.

Meerah et al. (2010) also affirmed that teachers are not conversant with various methods of teaching, yet they lack self-confidence when employing inquiry-based teaching methods in their classroom practices. As a result, they chose to give explanation to their learners in the form of perceptions and experiences from the textbooks point of view, instead of encouraging them to deal with matters on their own (Meerah et al., 2010). These researches uncovered the fact that teachers preferred to use traditional teaching methods, based on a teacher-centred approach (Abdullah et al., 2017). South African teachers in rural schools are wrestling with how to employ multiple teaching strategies that require them to become innovative, due to lack of exposure to such methods (Peat, 2009). Brown and Gordon (2009)

revealed that, learners acquire knowledge better in a teaching milieu that is well resourced and equipped with age appropriate materials. Glewwe, Kremer and Moulin (2009) criticise dependency on textbooks as the major teaching resource, claiming that this has fundamentally impacted negatively on learner performance.

Tshabalala and Ncube, (2016) are of the opinion that the scarcity of proficient teachers, poor teaching resources, shortage of sponsors to buy essential resources, poor quality of textbooks, classes which are overcrowded, poorly inspired teachers, managerial actions which are poorly coordinated, continuous relocations of teachers and principals, the deleterious responsibility of community assessments on the teaching learning route, and the imbalance in education prospects, impede successful attainment of mathematics knowledge.

Abdullah et al. (2017) further claimed that, teachers' acquaintance and understanding of assessment practices were inadequate to an extent that, disparity prevails amid teaching practices and the assessment policy application, which was conceived by non-existence of orientation programmes, which was conceived as a result of the lack of orientation programmes. Fleisch (2008) further noticed that teachers in underprivileged schools do have subtle opportunities of what learners can accomplish and therefore have to unravel the formal curriculum to back-up their lower expectations. These assertions were supported by Pinar (2010), who emphasised that South African learners from destitute communities do not have access to the ordered level needed to execute actions that require a high-level of learner aptitude.

Aden, Yahye and Dahir (2013) highlighted that regular school attendance is crucial because learners are more likely to thrive in academics when they attend school constantly yet it is factual that when learners devote more time learning, the better results they should obtain. Therefore, the overall amount of time that learners spend learning has always been considered as a probable predictor of school attainment as it is challenging for teachers and learners to develop proficiencies and forge ahead if substantial amounts of learners are often absent (Aden, Yahye & Dahir, 2013).

2.8. UTILISING PIAGETIAN AND VYGOTSKIAN THEORIES IN FRACTIONS TEACHING

The researcher in this study decided to review literature about Piagetian and Vygotskian theories of learning in order to compare and understand how fractions learning can be enhanced using the two theories. The literature below was clarified the reasons for the researcher in deciding to employ these theories in the study

Mensah and Somuah (2014) argued that when Piaget's and Vygotsky's theories are merged into teaching strategies in the foundation phase classroom, learners learning is intensified. Consequently, teachers should ensure a solid perception of Piaget's and Vygotsky's theories and provide learners with more chances to play and learn with peers (Mensah and Somuah (2014).

Mensah and Somuah (2014) highlighted that by using Piaget's theory in the classroom teachers acquire a better understanding of their learners' intellectual capacity and can also align their teaching strategies with their learners' cognitive level since the main objective of the teacher is to assist the learners construct knowledge. Constructivism basically presents a diverse approach to think about fractions knowledge and its development and it further represents a major theoretical shift in what knowledge is and how knowledge develops (Simon, 2000)

Slavin (2019) further argued that one of the most important values of constructivist theories of learning is that teachers cannot just provide learners with knowledge instead learners must assemble knowledge in their own minds, whereas the teachers provide learners with ladders that guide them to advanced understanding, yet the learners themselves must hike themselves up the ladders. Therefore, constructivist strategies are often called learner-centered instruction whereby the teacher turn out to be the leader on the side instead of the mentor on the stage, assisting learners to unearth their own sense instead of teaching and directing all classroom activities (Slavin, 2019).

Naroth and Luneta (2015) emphasised that learner evolution from concrete experience to a pictorial stage and finally to the abstract level is critical in learning because the progression permits learners to acquire a concrete perception of basic mathematical concepts and relationships before they can start operating at abstract level.

The Vygotskian viewpoint assumes that the ZPD allows children to learn in the presence of others who possess better knowledge of certain chronological and educational practices (Abtahi, 2017). Concurring to Vygotsky, actual development can only materialise in the ZPD, and learning is most effective when the scaffold is complemented to the demands of the learner (Vainas, Bar-Ilan, Ben-David, Gilad-Bachrach, Lukin, Ronen & Sitton, 2019). Zheng, Chen, Liu, Long, Zhao, Bai and Chen (2018) revealed that before any teaching can be administered, the teacher should envisage the intellectual status of the learners and assume their ZPD which will assist the teacher to plan a suitable representation of the knowledge to be conveyed to the learners, by so doing teaching would encompass joint mental activities between the teacher and her/his learners in particular.

Manyuchi (2016) argues that Vygotsky counter the view that learners are passive recipients of knowledge; instead they accentuate the necessity for learners to be actively involved in the construction of knowledge whereby learning is being done by the learners, not something that is inflicted on them. Scaffolding is therefore a significant view of constructivism in the sense that it encompasses collaboration between the teacher and learners or among the learners themselves whereby when the learners work on a task, the teacher provides scaffolds by directing learners in the apposite direction to stick within their ZPD (Manyuchi, 2016). Dlamini (2017) revealed that as learners intensely manipulate concrete materials, they breed a comprehensive variety of images that can be employed to manipulate abstract concepts mentally, for instance, presenting two learners an apple to share or folding paper to show the concept of half would assist learners to acquire the gist of the fraction symbol $\frac{1}{2}$ by enabling them to relate the symbol with the other forms of representation.

Therefore, Machaba (2013) argued that it is crucial that the teaching of fractions in the foundation phase is both learner centred and environment based wherein it is administered by complementing the above theories so that the learner can understand much better if taught by using objects from their own environment and also encourage learners to want to find solutions to problems on their own and this would be viewed as solving their environmental problems.

2.9. CONCLUSION

In conclusion, the following issues as highlighted in this chapter with regard to fractions teaching have been extensively researched both locally and internationally, except the challenges encountered when teaching fractions in grade 2 learners at schools in Koloti Circuit: Capricorn District, Limpopo Province. Consequently, the following factors were explored to configure the heart of the literature review in order to support the topic under research, namely; fractions teaching as a worldwide hurdle, fallacies about fractions edification, the importance of teaching fractions at foundation phase level, fractions teaching approaches, mathematics teacher content knowledge in South African schools, teacher challenges in the teaching of fractions and utilising the Piagetian and Vygotskian theories in fractions teaching.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter presents a comprehensive outline of the research design; population and sampling; data collection techniques and data analysis method. Furthermore, the quality criteria; ethical considerations; significance and delimitation pertaining to the study are also discussed in this chapter. The aim of this research was to explore how fractions are taught to grade 2 learners in schools in the Koloti Circuit, with the intention of understanding the challenges that are encountered by grade 2 teachers when teaching fractions to learners. Table 3.1: below portrays an outline of the research design and methodology employed in the research project.

TABLE 3.1: RESEARCH DESIGN AND METHODOLOGY OVERVIEW

Research Design <ul style="list-style-type: none">•Qualitative research approach•Interpretivist paradigm•Case study
Data Collection Strategies <ul style="list-style-type: none">•Document analysis•Classroom observations•Semi-structured interviews
Transcription <ul style="list-style-type: none">•Participants•Researcher
Data Analysis <ul style="list-style-type: none">•Coding•Themes•Categories

(Adapted from Ramollo 2014:96)

3.2. RESEARCH DESIGN

Research design refers to the layout in which a study is orchestrated, commencing from the conception of the problem awareness, including the problem statement and hypotheses, to the reporting of research findings (Rudhumbu, 2014). Mcmillan and Shumacher (2010) highlighted the fact that a research design is ordered into four main classes, namely; quantitative, qualitative, mixed method and analytic.

To achieve the purpose of this study, a qualitative research approach was employed in conjunction with interpretivist epistemology to enable the researcher to view reality as subjective, differing from person to person, in order to conduct the study with ease and to attain the study objectives (Scotland, 2012). Multisite case studies were employed where three sites were utilised to gather information and provide the researcher with an opportunity to secure an extensive, total view of the research problem and to promote and comprehend it (Baškarada, 2014).

3.2.1. Qualitative research approach

A qualitative research approach is defined as a detailed examination of a human being's discrete and collaborative communal deeds, opinions, ideas and beliefs that are mainly involved in capturing social phenomena from the participant's perspective (McMillan & Schumacher, 2010). The focal point of the qualitative research modus operandi is to unearth and comprehend the background, viewpoints, and ideas of the participants, with the aim of investigating their significance, motive, or authenticity (Hiatt, 1986). In addition, qualitative studies are mainly focused on investigating for comprehension of a phenomenon, instead of probing into causal relationships (Creswell, 2014).

A qualitative research approach was employed to explore the challenges encountered by grade 2 teachers when teaching fractions as the approach permits the researcher to acquire the ability to understand the truth about the innermost background of participants and further unearth how sense is constructed through culture, rather than to test variables (Corbin & Strauss, 2008; White, 2005). Since the

researcher was physically present during data collection, this approach assisted the researcher to acquire rich and detailed narrative descriptions directly from the participants, without manipulating any part of the narrative (McMillan & Schumacher, 2010).

Indeed, the chosen approach has properly assisted the researcher to assess the contextual knowledge of grade 2 teachers in the teaching of fractions; to determine which theories are applied in teaching fractions; and also establish how fractions are taught to the learners.

3.2.2. Interpretivist paradigm

Interpretivism is defined as a strategy which draws attention to the worthwhile character of people's personality and involvement in both communal and cultural life (Chowdhury, 2014; Elster, 2015; Walsham, 1995). Tekin and Kotaman (2013) assert that, in the interpretivist paradigm, social reality is dissimilar to natural reality because social reality deals with human beings and their relationships with each other, with the aim of attaining full comprehension of the implications of these social realities for those encountering them.

In this study, for the researcher to be able achieve the objectives of the research, namely: to assess the contextual expertise of grade 2 teachers when teaching fractions; determining which theories are applied when teaching fractions to grade 2 learners and establishing how fractions are taught to grade 2 learners at schools in Koloti Circuit, the researcher would therefore rely on the data that is provided by the sampled grade 2 teachers based on their proficiency, insight and perceptions in teaching fractions to these learners in order to extract the reality of the research.

To justify what the researcher highlighted above, Thanh and Thanh (2015) revealed that researchers who employ interpretivist paradigm and qualitative methods frequently go for experiences, understandings and views of individuals for their information to unearth authenticity instead of depending on numbers of statistics. Scotland (2012) further revealed that interpretive epistemology is a theory which is

grounded in actual global occurrences and, for that reason, the theory does not dispute a system of ideas that an economic or political theory may be based on, but it accepts them. Consequently, interpretive methodology is targeted at comprehending phenomenon from other people's perspectives, probing interaction between human beings, including the documented and anthropological circumstances which individuals live under (Creswell, 2009).

Klein and Myers, (1999) highlighted the fact that the interpretivism research approach is considered as an ideographic investigation of individual cases or events. The researcher would probe various participants to enrich the existence of the problem statement in Koloti circuit. Rahman (2017) revealed that the interpretivism approach has the capacity to comprehend various people's voices, meanings and events.

Interpretivism, by its nature, advances the worth of qualitative information in search of knowledge (Kaplan & Maxwell, 2005). In principle, this theoretical and research pattern is involved with the distinctiveness of a specific location, giving to the fundamental pursuit of contextual extent (Myers, 1997). In spite of interpretive research being acknowledged for its worth in dispensing contextual extent, its outcomes are regularly condemned in terms of credibility, dependability and confirmability (Eisenhardt, 1989 ; Perry, 1998).

To refrain from this theoretically precipitated condemnation, a small number of researchers recommend the usage of "triangulation" in order to investigate the communal sphere (Hammersley, 2003; Silverman, 2004). To support the above statement, Denzin (1970) noted that various and unprejudiced techniques should be employed if similar deductions are met, which possess substantially more dependability than a particular system of methods to tackle a hitch.

The following interpretive methods were employed by the researcher during this study: document analysis, observations and semi structured interviews. These methods were utilised to generate perception and comprehension of behaviour; and to clarify deeds from the participant's standpoint, without influencing the participants, in order to acquire qualitative data (Scotland, 2012).

3.2.3. Case study

The case study research method is defined as an empirical inquiry that examines the coexisting occurrence within its actual situation and is known for tackling research questions that entail why, how and what (Yin, 2009). This method permits the researcher to closely investigate data within a specific situation (Merriam & Tisdell, 2015). Furthermore, a case study is employed to comprehend the actual situation in a meaningful way, including vital contextual conditions, as they are highly relevant to the setting of the study (Yin, 2009).

Researchers highlight that, a case study is concerned with a limited number of units of analysis (often only one) such as an individual, a group or institution, which are studied intensively, (Creswell & Creswell 2017; Welman & Kruger, 2001). Its main essence is also to probe out the attributes of a specific entity, and its major distinctive feature incorporate aiming on an individual component, in depth characterisation of an occurrence, firmly attached to actual live situations and employs numerous information gathering techniques (Njie & Asimiran, 2014).

Aberdeen (2013) revealed that a case study must consist of a coherent plan, pre-outlined information gathering methods, and pre-resolute information analysis techniques. The case study approach was recommended for this study as it allowed the researcher to gain a better understanding of the problem at stake (Baker, 1999). In this study, multisite case studies of grade 2 classrooms were sampled from three sites (schools) in the Koloti Circuit in order to gather information and provide the researcher with an opportunity to secure an extensive total view of the research problem and be able to promote and comprehend the research problem (Baškarada, 2014).

3.3. POPULATION AND SAMPLING

The aim of qualitative research is to advance a deeper comprehension of an incident, rather than to make a sweeping statement about the findings (Naderifar,

Goli & Ghaljaie, 2017). Therefore, cautious selection of research sample can assist the researcher to perform a more detailed evaluation.

3.3.1. Population

Population is an aggregate of all subjects that comply with the entire series of guidelines which consists of the whole batch of individuals that are of concern to the researcher and to whom the research results can be generalised (Rudhumbu, 2014). Appropriateness standards postulate the traits that individuals in the population must have in order to be encompassed in the research (Polit & Hungler 1999). Therefore, for the purpose of this study, the population of the research constituted of grade 2 teachers from fifteen primary schools in Koloti Circuit.

Since Koloti circuit comprises of a population of fifteen primary schools with foundation phase classrooms, the researcher then grouped those primary schools based on their proximity and came up with three clusters i.e. A, B and C. Cluster A constituted of five primary schools whereby two of those schools are with big learner enrolment of more than 500 learners and two schools are with learner enrolment ranging from between 280 to 300 learners and the other school in cluster A is a small school of less than 120 learners from grade R-7 and the school offers multi-grade teaching in the foundation phase. In the remaining two clusters being cluster B and C, the learner enrolment in each of the schools ranges from 400 to 500 except in one school where the learner enrolment is less than 100 and the very same school was in the process of being merged with the other neighbouring schools.

3.3.2. Sample

A sample is defined as part of a research population which is chosen to take part in a study, symbolising the research population (Ary, 1996). In addition, a sample is also a class of participants singled out in such a way that its uniqueness epitomises the entire group from which they were selected (Ary, 1996; Polit, Beck & Hungler, 2001). Polit and Hungler (1999) further defined sampling as a procedure of choosing a fraction of a population to characterise the entire population which is then a

subgroup of a population components which is the utmost fundamental group about which data is gathered. Based on the scenario of the primary schools in Koloti Circuit that was discussed earlier on in section 3.3.1, the researcher decided to choose from cluster A, one big enrolment primary school and a small enrolment primary school which offers multi-grade teaching in foundation phase while from cluster B and C, only one primary school was chosen from the rest of the remaining primary schools because their learner enrolments were of the same range except in only one school that was in the process of being merged. The researcher could not risk choosing that school as it was in the process of merging which could disadvantage the researcher if the process could be completed prior data collection transpires.

Consequently, a total of three primary schools from Koloti Circuit were sampled by the researcher to participate in this study. One grade 2 teacher from each of the sampled schools participated in the research, resulting in three participants taking part in this study

3.3.3. Purposive sampling

Purposive sampling means that the participants are chosen based on the defining attributes that make them the bearer of the data needed for the study (Leedy & Ormrod, 2010; Maree, 2007). Since the researcher was determined to attain the research objectives, a purposive sampling technique was deemed suitable for this study. Purposive sampling was employed to allow the researcher to specify the participants based on their day-to-day duties and to locate them with respect to the knowledge that they possess (Johnson & Christensen, 2012).

Since, purposive sampling is a non-random technique that does not require any fundamental theories, the researcher determined what needed to be known and arranged to identify participants who were willing and able to provide the information, based on their mastery and understanding of the content knowledge and on their acquaintance with the teaching of the subject (Tongco, 2007). Conscripting participants for a study comprises two major tasks: identifying appropriate candidates and coaxing them to take part in the study (Polit & Hungler, 1999). In this

study, purposive sampling assisted the researcher to access an informative group of participants who were directly involved in the teaching of grade 2 fractions. The researcher further believed that this group of teachers would assist in dealing with the objectives of this research with ease.

3.4. DATA COLLECTION

In qualitative studies, the principal data collector is the researcher, who has to devote a substantial amount of time to collecting data in the natural setting, (Creswell, 2014). Since no research can transpire without a researcher, the researcher has to be engrossed in the study and become an instrument of the process (Machaba, 2013). In qualitative studies, the capacity of the researcher as the key information accumulation instrument necessitates the recognition by the researcher of distinctive worth, presumption and prejudices of the researcher at the onset of the research (Creswell & Poth, 2016).

Taherdoost (2016) revealed that in order to answer the research questions, it is unlikely that the researcher should be able to collect data from all cases. Therefore, the research in this study opted for non-probability sampling because it is frequently related with both the case study research design and qualitative research (Taderhoost, 2016). Purposive sampling was then selected by the researcher from the various non-probability samples. Maxwell (2012) defines purposive or judgmental sampling as an approach in which actual settings, persons or events are chosen purposely in order to deliver significant data that cannot be acquired from other choices. A sample of participants does not need to be illustrative and/or random, but a pure rationale is desirable for the enclosing individuals rather than others (Taderhoost, 2016).

In this study the aim of data collection is to uncover the antecedents and factors related with the occurrence of the study based on the participants' knowhow. Flick (2018) argued that qualitative researchers are concerned in accessing occurrences, connections and manuscripts from the participants' natural context in a state that confers opportunity to the peculiarities of them and the material in which they are

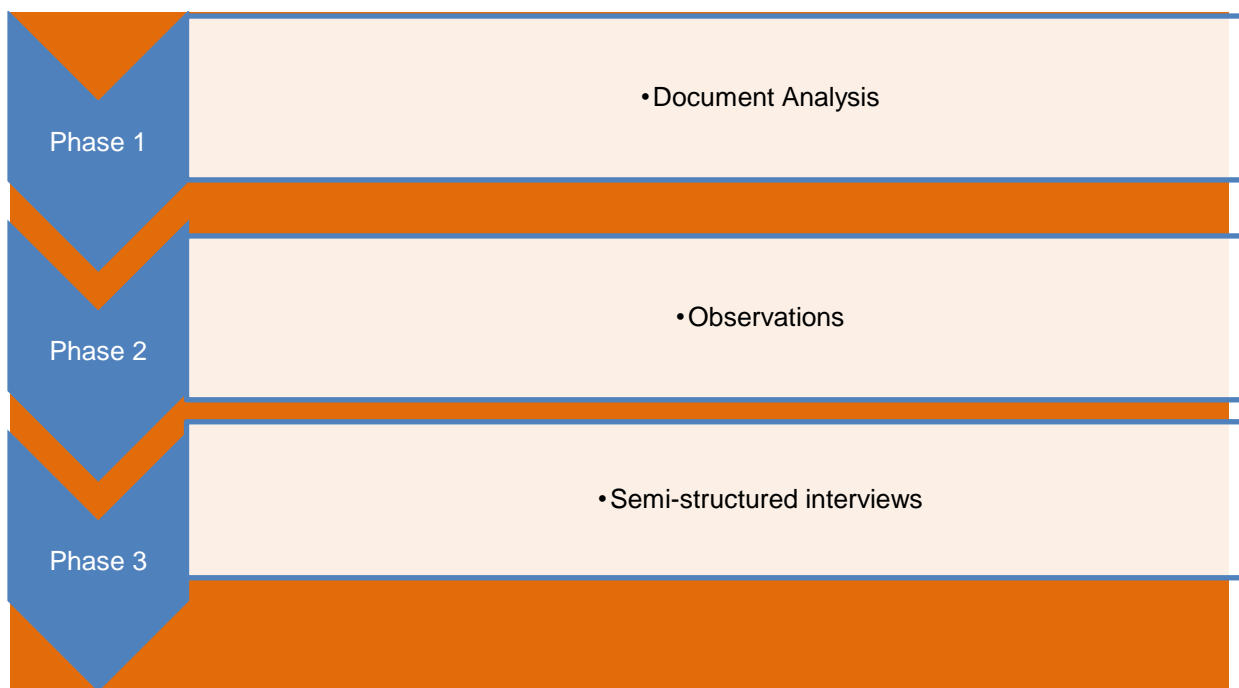
researched. McMillan and Schumacher (2010) further argued that the effects from inadequately collected data include: failure to answer research questions precisely; failure to repeat and authenticate the study; distorted findings resulting in wasted resources; misleading other researchers to pursue fruitless avenues of investigation and causing harm to participants.

The researcher in this study further collected data from the sampled participants by employing the following data collection methods; namely: document analysis, classroom observations and semi-structured interviews. The section below outlines the phases of data collection employed in this study.

3.4.1. Phases of data collection

For this study to become a success, the researcher employed three phases, as indicated in Table 3.2 below, in order to enhance triangulation and enable the merits of the data analysis to maximise both the plausibility and honesty of this research (Marishane, 2013).

TABLE 3.2: PHASES OF DATA COLLECTION



3.4.2. Data collection techniques

The researcher employed multiple data collection techniques on the basis of the interpretive assumption that an activity can solely be understandable when it is described in terms of numerous interacting elements, occurrences and procedures (Chikiwa, 2017). The section below explores how each of the data collection instruments were utilised during the research process.

3.4.2.1. Document analysis

Document analysis is a qualitative data gathering technique in which records are elucidated by the researcher to articulate sense about the thesis (Chikiwa, 2017). It is a process of scrutinizing and elucidating data in order to extract sense, obtain comprehension, and expand empirical knowledge (Bowen, 2009). Mackenzie & Knipe (2006) argue that document analysis is one of the major sources of qualitative data, which should be utilised concurrently with interviews and observations, in order to acquire rich qualitative data. In addition, Hopkins (2008) noted that documents present the study with previous data and comprehension of the matters that would not otherwise be accessible.

Document analysis was chosen as one of the most appropriate information gathering techniques for this study because it furnished the researcher with 'contextual richness' and because it could be employed to corroborate evidence from other sources (Bowen, 2009). The following documentations were analysed prior to the interviews with the participants taking place in order for the researcher to develop an insight into the research topic, namely:

- **Foundation Phase Curriculum Assessment Policy Statement:** This is a solitary, inclusive, and brief policy document, which has substituted the subject and

learning area statements, learning programme guidelines and subject assessment guidelines for all the subjects listed in the National Curriculum Statement (NCS) grades R-3 (DBE, 2011). This curriculum aims to ensure that children obtain and use information and abilities in modes that are noteworthy to their own existences (DBE, 2011).

- **Teachers' work-schedule:** This is an arranged order in which the topics are going to be covered by the individual teacher. Important however, is that the dates in the learners' workbooks or dates on which learners have done their formal/informal assessments must resemble to the dates as they are appearing on the work schedule.
- **Lesson plan:** It is a teacher's specified explanation of the way of teaching for a particular lesson to guide class learning. Lesson planning is aimed more specifically to ensure alignment across grades; avoid teaching from cover to cover; knowing how to teach the topic and it should be done across grades to avoid omissions and unnecessary repetition of topics.
- **Learner rainbow workbooks:** These are the learners' books wherein informal assessments are written by the learners and controlled by the teacher. The aim of the workbooks is to supply each learner with worksheets to perform numeracy skills that they have been taught in class and further assist teachers in tracing the advancement of learners and gives them extra support if needed (Hoadley & Galant, 2013).
- **Grade 2 Mathematics- Subject Improvement Plan (SIP):** It refers to a plan in which all the challenges that are encountered in grade 2 mathematics that hinders achievement of good results are outlined. Among others, the plan should also indicate the intervention strategies for the said challenges, the timeframe for addressing the identified challenges and the responsible person(s) for addressing the identified problems. The purpose of this plan is to track whether or not the teacher is able to eradicate the identified challenges and improve learner performance in fractions in particular.
- **Item analysis reports:** It is a process which scrutinises answers that are provided by learners to individual test questions in order to evaluate the quality of those questions and of the test as a whole. Item analysis reports are worthy in refining questions which will be used again in later tests.

- **Minutes for grade meetings addressing the teaching of fractions:** These are the records of grade meeting that are held by grade 2 teachers in the various subjects that are taught in grade 2. For the purpose of this study, the researcher will scrutinise the records for grade 2 mathematics and in particular challenges encountered with fractions teaching.
- **Evidence of parent consultation meetings:** These are the proofs that shows that parents do hold meeting with their children's teachers. The main aim of holding parent consultative meetings is to discuss learner performance with the parents and further assist one another to pave the way for the child in order to advance adequate academic results more especially in fractions.
- **Evidence of class visits conducted:** These are the proofs that indicates that the SMT is providing the necessary support to grade 2 teachers particularly in mathematics. The main aim of conducting a class visits is assist the teacher while there is still time to curb any challenges that might hinder learner attainment in various subjects at the end of the academic year.
- **Evidence of monthly written work output:** These are the records of informal assessments that are given to learners in a class, particularly on fractions partitioning. The aim thereof, is to verify whether enough written work is given to the learners.
- **Evidence of support programmes given to learners with learning barriers:** These are records of the broad range of activities which are offered by the teacher to illustrate support given to learners who maybe experiencing barriers to learning due to various factors. The aim of these records is to ensure that all learners receive adequate support irrespective of the challenges that they may have.
- **Evidence of catch-up programmes that were conducted:** These are records of programme that the teacher develops on his/her own to catch up the work that was not done during the teacher's absence from school. This programme is normally conducted after normal teaching hours. Parents of the affected learners must be informed prior the catch up programme can be administered in order for the parents to know the whereabouts of their children. The main aim of the programme is to teach the topics that were not taught by the teacher as per the work schedule due to the absence of the affected teacher.

- **Monitoring tools for quality assurance of assessment tasks:** It is a monitoring tool that is used by the departmental head in different grades to monitor the quality of assessment tasks that are given to the learners
- **Learner daily attendance registers:** This is a learner classroom register that is used to mark whether or not the learner is coming to school on daily basis or not. This register is marked on daily basis by the class teacher. The purpose of this register is to track how the learner attends the school.
- **Teacher movement registers and teacher leave register:** It is a register that is normally signed by the teacher every-time she/he leaves the school premises during learner contact time whereas teacher leave register is a register that is used by the school principal to file all the leave forms of a particular teacher and record the type of leave taken, and further update the number of leave days that are left for an individual teacher during a particular leave cycle. The main purpose of both registers is to track how an individual teacher attends school.

3.4.2.2. Classroom Observations

Observation is a data collection strategy which governs qualitative interpretive research (Cohen et al., 2010; Diaz Andrade, 2009; Merriam, 2008; Neuman, 2009). McMillan and Schumacher (2010) stated that field observation procedure is important during qualitative studies because the researcher would have the opportunity to learn how people in the setting interact and how things are organized and prioritized in that setting. The researcher in this study employed the strategy indicated above as the initial/primary data collection method in order to understand what is worthy to the individuals in the social setting of study; to be acquainted with the participants in order to review what would constitute suitable questions, how to solicit them, and which questions may best assist the researcher to achieve the research objectives, and to benefit the researcher to detect and direct rapports with the participants (Kawulich, 2012). Attached find the classroom observation schedule in **(Appendix C)**.

Certain intellectuals maintain that the researcher's participation when conducting field observations entails entering the participants' domain, confiding in them, being

known to participants and win their confidence, and to steadily capture comprehensive facts about everything that is perceived and detected (Bogden & Biklen, 1982; Van Wyk, 1996). The worthiness of the classroom observation procedure rests in its valuableness, since the researcher acts as both the researcher and a participant in the study (Babbie & Mouton, 2001:314).

Kawulich (2012) highlighted that as long as the researcher is in a communal place, it is habitually okay to observe participants without any formal permission, but when the researcher is invading on participant's lives and the intention is to record and report to the public domain the results of the research, it is necessary to make participants aware of the fact that the researcher is there as an observer and that they are being observed. Consequently, the researcher ensured that permission is granted first in order observe the participants without invading their lives.

The researcher then conducted a total of three classroom observation sessions per participant totalling to nine observations for the three sampled participants for the entire research process. Numerous classroom observation sessions were conducted with the intention of having a clear outlook of unscheduled proceedings, which would assist in delivering rich, comprehensive explanations of the social setting in the field notes and further assist the researcher to develop new questions to be asked to the participants (Kawulich, 2012). The classroom observation sessions were conducted on various days to allow the researcher enough time to transcribe what transpired during the session. The following were observed by the researcher during the classroom observation sessions, namely: school attendance and punctuality, class-size, availability of teaching resources, classroom management, how learning barriers were addressed and curriculum implementation.

During the reporting period, the researcher articulates the gathered data from the perspective of being an active participant, rather than that of a spectator expert who passes a ruling on participants (Creswell, 2014). Classroom observations further assisted the researcher to acquire adequate information about the actual behavioural patterns of the participants (Ary et al., 2014). Additionally, classroom observations were conducted to determine whether the participants were steadfast in what they stated during the interviews which would also increase the authenticity and credibility

of the data collected. The discoveries derived from classroom observations are discussed below.

The researcher conducted classroom observation sessions to accumulate an intense perception regarding the teaching of fractions to grade 2 learners and the challenges encountered by their teachers when teaching fractions to these learners (Maree, 2007). The researcher in this study observed the following, namely: both teacher and learner attendance, availability of catch-up programmes when fraction lessons were missed, whether teacher learner ratio was conducive for teaching and learning of fractions in particular to take place, availability of concrete resources that are utilised for teaching fractions, how the teacher managed their classrooms to avoid disruptive behaviours when presenting fractions, ability of the teacher to address barriers that could hamper effective teaching and learning of fractions, measure the degree of the teachers' ability to plan fractions lessons, measure the ability of the teacher to engage all learners, ability to implement instructional strategies used to teach fractions partitioning in particular and also observe any other relevant documentations that could assist in collecting adequate data for the study.

Classroom observation sessions schedules were compiled, during which the researcher captured field notes about verbal and non-verbal behaviours, including the participants' attitudes and descriptions of the environment during the observation period (Maree, 2012).

3.4.2.3. Semi-structured interviews

Blandford (2013) highlighted the fact that interviews are a common alternative way of collecting verbal information and that they are pre-eminently suitable for grasping the views of the participants and of capturing incidents. The researcher ensured prudent composition of the interview schedule prior commencement of the research process (Arthur & Nazroo, 2003). Individual semi-structured interviews were conducted with three grade 2 teachers from the sampled schools because of their direct and pivotal role which they play in the teaching of fractions in their classrooms. The interview questions were structured in such a way that different participants were asked the same questions in order to attain data saturation (Fusch & Ness, 2015).

The interviews were conducted during working hours and mainly in Sepedi, which is the mother tongue of the participants. Newcomer, Hatry and Wholey (2015) mentioned that when potential participants do not speak English, thorough translations and multilingual interviewers will be essential otherwise interviews can fail if it is casually assumed that everyone shares our vocabulary, acronyms, and lingo. The researcher therefore opted to utilise the participants' mother tongue when conducting interviews to ensure that the interview questions are well understood by the participants and further assist the participants to feel free and elaborate more when answering questions. At a later stage the data was transcribed to English.

The interview sessions were conducted after the researcher received approval letters from both TREC and Limpopo Department of Education. The researcher then visited the participants at their respective schools to conduct the interviews. In order for the interview sessions to be conducted with ease, the researcher ensured that each participant is allocated two days to answer the interview questions. The splitting of the interview questions ended up with six interview sessions that were conducted in the whole process and each of the three participants was interviewed for two days.

Newcomer et.al, (2015) highlighted that, semi-structured interviews are excellently suitable mainly when more than a few of the open-ended questions require follow-up queries, and if you want to ask probing, open-ended questions and want to know the independent thoughts of each participant in a group, if you need to ask probing, open-ended questions on topics that your respondents might not be candid about if sitting with peers in a focus group. The researcher therefore, decided to employ the semi-structured interviews because participants were asked probing open-ended questions that needs them to give their independent thoughts. Furthermore, when asking such type of questions in a focus group, participants may end up not feeling free to express their own thoughts as they would think that others will undermine them for the answers that they will be advancing to the researcher.

During this study, the researcher employed the following steps for the interview procedure, as proposed from Ritchie, Lewis, Nicholls and Ormston (2013), in order to gather qualitative data from the participants:

- **Reaching the destination:** The researcher ensured that participants were calm during their initial consultation as this meeting had decisive repercussions with respect to the favourable outcomes of the interview.
- **Presenting the research:** The researcher ensured that the participants were acquainted with the aim of the research; that they granted informed consent of their willingness to have the interviews captured by tape-recorder and camera, and that they understood their rights to withdraw from the interview process.
- **Starting the interview process:** Participants were accorded confidence during this stage and the background information was gathered in order to contextualise the interview process as a whole.
- **During the interview process:** Probing questions were asked so that participants could elaborate when answering interview questions.
- **Concluding the interview process:** The researcher gave an indication that the interview process was coming to the end so that the participants could prepare for its termination in order to ensure that there were no loose ends.
- **After the interview:** The researcher showed gratitude to the participants and highlighted to them what would transpire with their data. In addition, the researcher ensured that the participants were left feeling comfortable with what had transpired during the interview process.

Matters that were explored during the interview process were comprised of the following:

- Demographic variables that are encountered by grade 2 teachers which could hamper the proper teaching and learning of fractions by their learners;
- Approaches that the teachers normally use when teaching fractions;
- Any theories that are drawn upon with respect to the employment of the teaching approaches that were indicated;
- Challenges that were normally encounter when teaching fractions;
- Aspects of fractions that were most problematic to grade 2 learners
- Recommendations that could be employed to maximise learner performance in as far as fractions teaching is concerned.

The researcher ensured that the transcribed data was taken back to the participants in order for them to confirm the authenticity of their answers to the interview questions. The researcher also ensured that the acquired data was transcribed as soon as possible and started analysing the responses soon after (Mugweni, 2012).

3.4.2.4. Piloting

A pilot study is a partial research design with limited topics that goes along with the primary research strategy in all ways (Nkabinde, 2012). Opie (2005) highlighted the fact that embarking on a pilot study plays a valuable role in drawing up an interview schedule, pointing out this task is regularly ignored or even overlooked by novice researchers. Researchers can detect likely setbacks to their research projects prior to performance of the main study by way of analysing the outcomes of a pilot study (Hittleman & Simon, 2002). Hittleman and Simon (2002) resolved that piloting awards novice researchers a chance to scrutinise the developed interview schedule and make proper alterations where necessary. The pilot study in this case involved a miniature replication of the actual study (Nkabinde, 2012) and was conducted with two grade 2 teachers within the Koloti Circuit, based on similar attributes to those of the sampled group of participants. Pilot studies permit a researcher the opportunity to run through, and sharpen up, information-gathering techniques, data collection tools and/or probing strategies, offering the researcher opportunities to hone interviewing skills with participants (Yin, 2015). The researcher in this project conducted a pilot study in order to establish the following, as stated by (Nkabinde, 2012):

- Achievability of the study;
- To ascertain the dependability and authenticity of research tools;
- To ascertain trustworthiness of participants towards information gathering in the main study;
- To determine how suitable, plausible and realistic the research tools were;
- To unearth on setbacks that may arise preceding to the main study; and
- To test the exact time needed for completion of the feedback forms.

During the first pilot session, the researcher discovered that there were some loopholes with regard to the way the participants answered some of the questions on the interview schedule, as well as some questions were not easily understood by the participants. The researcher therefore ensured that probing questions were asked in order for participants to understand questions better and to be in a position to elaborate when answering these questions. Consequently, the last pilot session yielded fruitful results, as the interview guide proved useful as a tool to collect data and did not comprise any perplexing questions.

3.5. DATA ANALYSIS

Bloomberg & Volpe (2018) define data analysis as the action of logically scrutinizing and designing the acquired data, with the purpose of constructing meaning of it and to unearth constructive data which can be employed by a researcher to reach deductions and substantiate decision-making. de Vos, Strydom, Fouché, & Delport (2011) argued that data analysis entails formulating the underlying structure for conveying the core of what is exhibited by the acquired data and is a course of action that creates tranquillity, formation and the gist of the essence in the accumulated data. Merriam (1998) described data analysis as an activity involving the constructing a sense of what individuals have said and what the researcher has seen and read. Furthermore, data analysis refers to the procedure of conveying sequence, design and sense to the extensive data which has been acquired (de Vos et al., 2002; Marshall & Rossman, 2014).

The initial step in the process of data analysis entailed the developing themes from the questions in the interview schedule and, thereafter, transcribing the raw material, as well as expanding upon this material, where necessary. This initial procedure included the official capturing of classroom observation notes, the information from document analysis and the interview data, in order to enable critical in-depth data analysis.

The second step involved embarking upon the process identified as coding which, according to McMillan and Schumacher (2010), entails the organisation of data into categories and, thereafter, identifying patterns and instituting relationships between

the categories. Coding and categorisation of raw data were applied in order to answer the postulated research questions (Ngulube, 2015). Data analysis was conducted separately and independently from the data collection in order to synthesise and make sense of the data collected (McMillan & Schumacher, 2010). The researcher employed both formative and summative aspects of data analysis. According to Ravitch and Riggan (2016), formative data analysis involves the continuous reflection upon the data as it unfolds, while the process of summative analysis materialises after the data has been collected hence, it is an important dynamic of qualitative research. The researcher conducted data verification after the data collection was finalised in order to draw the conclusion for this research. During this study, data was analysed as soon as the process of data collection was completed. The large amount of data was organised to facilitate coding. The data-coding process was based on the following steps, as specified by McMillan and Schumacher (2010), and the results were presented in narrative form:

- The researcher began by identifying and analysing segments in order to determine codes in a manner that each segment could be labelled by at least one code;
- Data was then compared and grouped according to themes;
- Similar codes were put together to form a category, which was labelled to capture the essence of the codes.

3.6. DATA ANALYSIS PROCESS

During the data analysis process, the researcher was interlocked with the data in order to make logic out of it which meant jeopardising the researcher's everyday stance, attitudes or knowledge in order to acknowledge the 'liminal' experience of living between familiarity and strangeness (Denzin & Lincoln, 2000). The researcher's feelings therefore oscillated between a feeling of familiarity with the participants' attributions of meaning in their lives and a feeling that the researcher could not identify personally with what they could be feeling or describing. This liminal experience encouraged the researcher to explore the data with a sense of flexibility and openmindedness, improvisation and creativity as well as planning and adherence to steps and rules (Denzin & Lincoln, 2000).

Analysis transforms data into findings by bringing order, structure and meaning to the mass of collected data (de Vos, 2005). The analytical process “does not proceed tidily or in a linear fashion but is more of a spiral process; it entails reducing the volume of the information, sorting out significant from irrelevant facts, identifying patterns and trends, and constructing a framework for communicating the essence of what was revealed by the data (de Vos, 2005).

There is an “inseparable relationship between data collection and data analysis, and this is one of the major features that distinguish qualitative research from traditional research” (de Vos, 2005). Accordingly, as the data was being transcribed and translated, the researcher was capable of identifying patterns of expressions that alerted the researcher to be aware of themes that were similar or divergent as more data unfolded. Furthermore, “data analysis does not in itself provide answers to research questions as these are found by way of interpretation of the analyzed data” (Kruger, de Vos, Fouché & Venter, 2005). Interpretation involves explaining and making sense of the data (de Vos, 2005). This again involves an ongoing engagement with the process, in that interpretation and analysis are closely intertwined as the researcher automatically interprets as he or she analyzes (Kruger et al., 2005). Hence, it was from this mutual process of data collection and analysis that a “plausible and coherent” understanding surfaced (de Vos, 2005).

3.6.1. Creating themes: traits, synopses and reduction

The researcher carefully went through the transcripts in order to acquire a complete perception of each session. The significance of this step is to personally submerge into the facts, in order to get a logic of the interviews holistically prior compressing them into segment (de Vos, 2005). The researcher therefore spotted trends or recurring patterns in the data collected that revealed what the participants sensed intensely about and clustered those recurring patterns and commonalities repeated by participants into generative themes (de Vos, 2005). Creating themes with an understanding of participant traits and synopses, the researcher revealed that the perception articulated by one participant helped out to comprehend and make sense

of what came next from another participant. This merited one of the goals of analysis, which is to “produce meaningful condensations that make it possible to gain from one participant an understanding that can enhance one’s understands of another participant as well” (Falmagne, 2006:181).

To generate direction from diverse patterns and interconnections of participants’ utterances, the researcher applied a process of coding as it is outlined in the section below.

3.6.2. Coding of themes

The researcher identified each piece of the transcribed participants’ descriptions and followed the theme analysis process in order to enable logical data report when the themes are portrayed and substantiated by citations in the final written dissertation (Neuman, 2006).

3.6.2.1. Open coding

The researcher started with open coding which necessitated reading and rereading the collected data in order to make certain how patterns could be clustered and coded. Open coding involves naming the identified patterns or categories of expression, breaking them down into discreet parts, closely examining them, comparing them for similarities and differences, and questioning the phenomena that are reflected in them (de Vos, 2005). In this study, the clustered patterns or themes were tinted in a specified colour and then named each theme depending on its focus or subject matter and marked the name down in another colour in the text above the emphasised narrative and this naming process is called “conceptualising the data” whereby the name stands for or represents a phenomenon (de Vos, 2005).

3.6.2.2. Axial coding

Axial coding which entailed considering the links and connections between the themes so that interrelated themes could be fused into clusters was employed. de Vos (2005) termed this classifying or looking for categories of meaning as it encompasses seeking for groupings of connotation that have internal convergence and external divergence. de Vos (2005) further qualifies this by explicating that the categories or themes should be internally consistent, but distinct from one another. To synchronise the above, the researcher grouped the tinted themes from the various participants' descriptions that were alike, and repositioned them to a new manuscript.

3.6.2.3. Selective coding

Selective coding was the ultimate procedure whereby all themes, from the manuscript of the combined participant's themes, were alienated into a designated number that encompassed the ultimate presentation through examining the data, and lessening it to a trivial, convenient set of themes to write into the concluding storyline (de Vos, 2005).

At times the researcher was inclined to become distorted when moving the three methods because piloting of the procedures above made the researcher to recognise that the margins between one type of coding and the subsequent coding could be synthetic, resulting in various forms of coding not necessarily taking place in sequentially (de Vos, 2005). Diverging instances of the identified patterns, trends and themes were noted from the narratives of the participants and they gave new meanings to the researcher's comprehension of the manuscript. Therefore, the researcher was inspired to constructively assess the "very patterns that seemed so apparent" (de Vos, 2005:339) and explore for other, credible and alternate descriptions for the data acquired.

The following six themes that will be portrayed in chapter 4 emerged from the analysed data, namely: demographic variables that hampers proper teaching; approaches employed when teaching fractions; theories of learning that are drawn during fractions teaching; challenges experienced when teaching fractions; aspects

of fractions that are problematic to learners and teachers'content professional development programme.

3.7. QUALITY CHECK

Since qualitative researchers do not employ instruments with standard metrics about authenticity and consistency, it is pertinent to dispatch how qualitative researchers ascertain that the research study's findings are credible, transferable, confirmable, and dependable (Treharne & Riggs, 2014). Trustworthiness is all about establishing these four things, which are described in more detail below.

3.7.1. Trustworthiness

Guba (1981) highlighted the following four trustworthiness concerns that any researcher needs to become cognisant of, regardless of their research paradigm, namely; truth-value, applicability, consistency and neutrality. In qualifying to the aforementioned concerns, the researcher maintained the following elements of trustworthiness, namely: credibility; dependability; confirmability and transferability. Below is a brief explanation of each of the above elements and how the researcher addressed them.

3.7.2. Credibility

Mntunjani (2016) revealed that credibility plays a key role in authenticating trustworthiness in a qualitative study. Credibility is directed towards demonstrating that the results of qualitative research are plausible or accurate from the standpoint of the participants in the research (Trochim, 2006). Furthermore, credibility determines whether or not the research findings portray reasonable knowledge obtained from the participants' actual data and is the exact exposition of the participants' bona fide sentiments (Graneheim & Lundman, 2004; Lincoln & Guba, 1982).

During this research project, the researcher ensured that the product embodies conceivable information which is drawn from the participants' original views by establishing credibility in the research (Anney, 2014). Mntunjani (2016) argued that the approach in which information is translated may vary from researcher to researcher, but the vital ingredient is plausibility and being able to defend the reasons for your standpoint. The following credibility strategies were employed by the researcher to establish the quality of this research:

- **Prolonged engagement:** The researcher spent a week on each site in order to grasp the main issues that might have an effect on the quality of the data and to promote trust with the participants.
- **Triangulation:** Different research instruments, such as document analysis, observations and semi-structured interviews, were utilised to ensure corroborating evidence.
- **Member checking:** Data and interpretations were tested continuously in order to ensure that the researcher was not showing any favouritism when analysing and interpreting the results.

3.7.3. Dependability

Anney (2014) argued that, dependability refers to durability of the research findings over a period of time. It entails appraising the outcomes, clarifications and suggestions given during the research to ensure that they are all taken care of by the facts acquired from the participants of the research (Cohen et al., 2011). The researcher maintained the following dependability elements during this research project, namely:

- **Audit trails:** The researcher ensured the safekeeping of raw data, interview and observation notes, documents and records collected from the field to serve as evidence of how the data were collected, recorded and analysed, and later utilised by the researcher to account for all the research decisions and activities.
- **Peer examination strategy:** The researcher discussed the research process and findings with the supervisors based on their qualitative research

background, in order for them to assist in establishing the research categories that were not covered by the research questions and to promote the study's integrity.

3.7.4. Confirmability

Confirmability is defined as the extent to which the outcomes of an investigation could be verified or proved by other researchers in order to confirm that data and the way findings are explained are not merely figments of the researchers' imagination, but clearly originate from the data (Anney, 2014; Shenton, 2004). The researcher employed the following elements to preserve confirmability in this study:

- **Reflexive journals:** The researcher ensured that all the documents that comprise incidents that occurred in the field, including personal expressions that emerged during the inquiry, were safely kept in order to review, provisionally translate, and correctly strategize the collected data.
- **Triangulation:** The researcher employed various research instruments to minimise the effect of bias that could occur during the investigation process.

3.7.5. Transferability

Transferability refers to the extent to which the outcomes of qualitative research can be conveyed to other settings with other respondents (Anney, 2014; Li, 2004). The following were utilised to safeguard transferability of the research:

- **Thick descriptions:** The researcher assembled thick descriptive data in order to permit resemblance of this setting to other potential settings to which conveyance might be considered.
- **Purposive sampling:** The researcher employed this sampling method as it assisted the researcher to pay particular attention to key informants, who were knowledgeable about the issues under inquiry and which yielded substantial

in-depth findings which other probability samplings methods would not have done.

3.8. ETHICAL CONSIDERATIONS

Neuman (2011) highlighted that, ethical issues are the considerations, predicaments and disputes that emerge in connection with the acceptable way to orchestrate a research. McMillan and Schumacher (2010) declare that researchers should have a thorough knowledge of their ethical and legal responsibilities when conducting research. Cohen et al. (2010) further argued that social researchers are normally obligated to show accountability, not only to their profession in their quest for data, but also to the field they rely on for their employment.

Consequently, the researcher in this study was guided by the following principles and guidelines in order to uphold the high research ethics required to protect the rights of participants that took part during the study. The researcher considered voluntary participation, sought for consent from the participants, while confidentiality and anonymity of the participants were assured, before conducting the study.

3.8.1. Permission

The researcher acquired permission from the following bodies before embarking on the research, namely:

- Approval letter from TREC serving as notice to allow the researcher to carry out the study.
- Permission letter from District Director (Capricorn District: Department of Education Limpopo) which permitted the researcher to conduct the research in selected schools in Koloti Circuit.

After acquiring all the above letters, the researcher then visited the sampled schools in order to make arrangements with the school principals and the participants, showing them all the above approval letters.

3.8.2. Informed consent and voluntary participation

Authentic and unexpurgated details were disseminated to participants to enable them to understand the investigation wholly so that they make voluntary and informed decision about their possible participation (Sarantakos, 2005). Participants were informed of their rights to participate in the research, including their right to withdraw their participation at any time during the course of the study without any penalty being imposed on them (McMillan & Schumacher, 2010). The researcher further explained to the participants the benefits of participating in this research, so that they were not tempted to withdraw their participation during the course of the research.

Consent letters (**Appendices: A1 and A2**) were given to the grade 2 teachers who participated in this study. Principals of schools, who serve as guardians of the grade 2 learners as minors in this research, were also issued with consent letters. The researcher ensured that the intentions of the research were clearly explained and understood by all the participants before they participated in the research (McMillan & Schumacher, 2010). Consent from participants and learner-guardians was obtained by asking them to append their signatures on the consent form (**Appendices: B1 and B2**) which was issued to them before commencement of the research.

3.8.3. Anonymity and confidentiality of participants

Since this research dealt with human beings, the names of the participants were never disclosed to the public. This was done in order to protect their lives at a later stage (McMillan & Schumacher, 2010). Ethics etiquette in research demands that steps to safeguard participants' individuality against detection should be taken, including informing the participants that their identity and the data they furnished would be dealt with in absolute confidentiality in order to safeguard their identity and that of the school (Denzin & Lincoln, 2000). Consequently, the privacy of all the participants that were employed during this research process was assured at all times and strict measures were adhered to when storing the data so that participants

are not embarrassed or have their lives endangered at a later stage (McMillan & Schumacher, 2010). The following practices, as highlighted by McMillan and Schumacher (2010), were employed by the researcher to uphold the anonymity and confidentiality of participants in this research project:

- Utilisation of pennames instead of the participants' real names when analysing data and reporting the findings on the research;
- Making every effort to prevent anyone outside of the research project from connecting individual participants to their responses;
- Never deliberate on and/or confer with other people about the issues that emanated from the participant interviews in ways that could identify the participant.
- Lastly, the researcher ensured the separation of data from identifiable participants and stored the code linking data to participants in a secure place.

3.8.4. Privacy and security of data

During the course of this research, the researcher ensured that all the information that was acquired from the participants, including their identity, was restricted to the researcher only (McMillan & Schumacher, 2010). The following practices, as highlighted by McMillan and Schumacher, (2010), were maintained by the researcher to increase the level of privacy and security of data, namely:

- Employment of study codes on data documents instead of recording identifying information.
- Keeping a separate document that linked the study code to participants' identifying information locked in a separate location with access to this document restricted to the researcher only.
- Removal of face sheets containing identifiers from research instruments containing data after receiving them from the study participants.
- Properly disposing, destroying, or deleting study data / documents.
- Limiting access to identifiable information.
- Securely storing data documents within locked locations.
- Assigning security codes to computerized records.

- Strict measures were adhered to when storing the data so that participants are cannot embarrassed or their lives endangered at a later stage
- Ensuring that the research findings do not result in any form of physical or mental discomfort, or injury to the participants. This included not divulging information that may result in embarrassment or danger to the home life, school performance and friendships of the participants, as well as direct harmful results.

3.9. SIGNIFICANCE OF THE STUDY

Proficiency with fractions is regarded as the base for understanding algebra and becoming more successful with complex mathematics (Fuchs et al., 2013). Fractions convey a significant role in mathematics given that; they built an underlying basis which assists learners to acquire topics related to percentages, ratios and decimal numbers successfully (Ndalichako, 2013). They constitute a decisive component of mathematics understanding and opens doors towards careers that are in demand (Tian & Siegler, 2017). According to Hurrell (2013), fractions afford teachers the insight to develop the learners' understanding of numbers and relationships between numbers. Fractions furnish learners with important conceptual foundations for the growth and understanding of other number types and algebraic thinking (Hurrell, 2013). Furthermore, fractions are also vital for theories of cognitive development, in general and numerical development, in particular (Lortie-Forgues et al., 2015).

The researcher, therefore, through the findings of this research, intends to close the gap between what is currently posing as a challenge to grade 2 teachers in Koloti Circuit when teaching fractions and provide recommendations to the Department of Education, in general, and grade 2 teachers, in particular, including adequate teaching approaches which could enhance learner performance in fractions; resulting in the high performance of learners in mathematics at various schools.

3.10. DELIMITATION OF THE STUDY

The research was restricted to the primary schools offering foundation phase in Koloti Circuit (Capricorn District, Limpopo). Its focal point was centred on grade 2 classes and teachers. The research focused on the challenges encountered by grade 2 teachers when teaching fractions to the learners.

3.11. CONCLUSION

The chapter dealt with a comprehensive probing of the research design, population and sampling, data collection techniques, data analysis method and the data analysis process. Furthermore, the quality criteria and ethical considerations were discussed in detail. Lastly, the significance and the delimitation of the study pertaining to the research were also conferred in this chapter.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DESCRIPTIONS

4.1. INTRODUCTION

The preceding chapter conveyed a thorough presentation of the qualitative approach and the research design was presented to answer the postulated research questions. The researcher commenced with data collection subsequent the receipt of endorsement of the research ethics application. Participants' reactions were documented during the data collection strategies portrayed, namely: document analysis, observations and semi-structured interviews.

The rationale behind this episode intends to convey an analysis and interpretation of the gathered data in order to respond to the postulated research questions, which sought to establish the challenges encountered by grade 2 teachers when teaching fractions. Furthermore, analysis and interpretation of the collected data abetted in providing credibility to the notion that, teaching fractions in grade 2 poses challenges to teachers.

Consequently, the analysis and interpretation of the collected data informed the purpose of this research. Furthermore, the analysis of the gathered information was imperative to establish exactly those factors that may be contributing to the challenges encountered when teaching fractions in grade 2 in order to arrive at insights that will develop a sound perception of the occurrence being studied.

To start with, the immensity of the collected data was carefully considered and the researcher came up with the following codes as shown in Tables 4.1 to 4.4 in order to preserve anonymity of the sampled schools and research participants. **Mpho, Pheladi, and Lerato** were chosen as the participants' pennames during this study as depicted in Table 4.1 below. Collected data was also coded in order to preserve it and to ensure that no one is able to link the collected data to participants. Transcribed data was then coded and noteworthy concepts were picked out and

carefully positioned into themes and categories for a thematic analysis of the research, as indicated below.

TABLE 4.1: CODES FOR PARTICIPANTS IN THE STUDY

Code	Code description
#T-Mp	Teacher- Mpho
#T-Ph	Teacher- Pheladi
#T- Le	Teacher- Lerato

4.2. EDUCATIONAL QUALIFICATIONS AND YEARS OF TEACHING IN GRADE 2

The participants' educational qualifications and teaching experience in grade 2 were raised in questions 1 and 2 of the interview schedule (**Appendix: D**). The acquired responses enabled the researcher to develop an analysis of the participants' competency levels and professional maturity with regard to teaching mathematics in foundation phase classrooms. The researcher employed pennames to ensure anonymity of research participants. The participants' educational qualifications are exhibited in Table 4.2 below.

TABLE 4.2: EDUCATIONAL INFORMATION OF PARTICIPANTS

Penname	Gender	Academic and Professional Qualifications	Teaching Experience in grade 2	Subject specialisation in Mathematics
Mpho	female	BA degree	5yrs	none
Pheladi	female	PTC and HED	13yrs	none
Lerato	female	JPTD; HDE; B.Ed (Foundation phase); B.Ed	26yrs	yes

		Hons(Psychology in Education)		
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An analysis of the participants' educational qualifications, as portrayed in Table 4.2 above, revealed that all the participants were qualified teachers. Coincidentally, all the teachers in schools that were sampled for this study were female teachers. A transcription of their responses and an analysis regarding their educational qualifications and teaching experience in grade 2 emerged as below:

#T-Mp: *"I obtained Bachelor of Arts (BA) with one of the universities in South Africa and specialised in Languages. I started teaching grade 2 in 2014 at another school before being appointed here in 2016 and was allocated grade 2 on my arrival. In total, this is my fifth year teaching grade 2".*

From the above quote it was discovered that, even though teacher Mpho is a qualified teacher and has 5-years' experience in teaching grade 2, which is quite satisfactory, she did not specialise in foundation phase teaching. Furthermore, she had, to date, never specialised in mathematics at tertiary level, which posed a challenge to her with regard to mathematics teaching. She only got used to teaching grade 2 through the experience that she acquired.

#T-Le: *"I acquired Junior Primary Teachers' Diploma (JPTD) with one of the former colleges specialising in Mathematics and Languages. From there I registered Bachelor of Education (B.Ed) as a part-time student and specialised in foundation phase teaching and also acquired Bachelor of Education Honours degree (B.Ed Hons.) specialising in Psychology in Education which I also did while I was working as a teacher. I taught grade 2 for twenty-six years".*

The above extract revealed that teacher Lerato is a highly qualified teacher and her teaching experience in grade 2 is quite extensive. During her studies she specialised in foundation phase teaching and also majored in mathematics. In this regard teacher Lerato outshines all the other participants investigated during this study.

#T-Ph: *“After passing Form III which is now known as grade 10, I went to college where I obtained my Primary Teachers’ Certificate (PTC) and I started working as a teacher in the early eighties. From there I acquired my senior certificate which is now known as grade 12 through private studies and then I registered Higher Diploma in Education (HDE) also as a part-time student. In all my qualifications I have never majored in Mathematics. I started teaching grade 2 in 2005 when I was appointed as a principal at this school as I was the only female teacher by then in the school, working with other two male teachers, and since then, I had to deal with multi-grade classes wherein grades 1 to 3 learners are combined in one class. I therefore have 14yrs teaching multi-grade learners from grade 1 to 3”.*

The above excerpt has disclosed that teacher Pheladi has specialised in primary teaching, although she has never specialised in mathematics at tertiary level. Her teaching experience revealed that she taught grade 2 for 14 years, which is quite a lengthy period of time.

4.3. DOCUMENT ANALYSIS

Document analysis is a procedure that is normally practiced by a researcher to unravel various manuscripts when conducting qualitative research in order to articulate sense about the appraised subject (Bowen, 2009). Document analysis involves that facts are handled by way of codification, classification and clarification (Yu, Jannasch-Penell & Digangi, 2011). Like other investigative methods in qualitative research, document analysis coerces the researcher to scrutinise data and understood it, in order to draw out meaning, gain understanding, and develop empirical knowledge of the study(Bowen, 2009).

For the purposes of this study, mute or trace evidence, such as cultural artifacts were not scrutinised, instead the researcher focused on documents that may be used for systematic evaluation such as attendance registers, minutes of meetings; policy documents; learner workbooks , lesson plans and item analysis reports. The rationale for conducting document analysis during this study was to combine it with other qualitative reaserch methods suach as classroom observations and semi-structured interviews as a means of triangulation(Bowen, 2009).

The following codes, as reflected in Table 4.3 below, were utilised by the researcher to analyse the documents from the participants in order to develop insights into the research topic.

TABLE 4.3: CODES FOR DOCUMENT ANALYSIS OF PARTICIPANTS

Code	Code description
Da#T-Mp	Document analysis-Teacher Mpho
Da#T-Ph	Document analysis-Teacher Pheladi
Da#T-Le	Document analysis-Teacher Lerato

The researcher in this study analysed the documents as indicated below, the purposes for analysing the documents, together with the findings thereof, are also presented.

- Foundation Phase Curriculum Assessment Policy Statements:** This is a solitary, comprehensive, and summarised policy document, which has substituted the subject and learning area statements, learning programme guidelines and subject assessment guidelines for all the subjects including mathematics that are scheduled in the NCS grades R - 3. The policy document further specifies the extraction of knowledge, skills and values worth learning in South African schools. This curriculum aims to safeguard that children obtain and employ their awareness and abilities in modes that are important to their own lives. In this regard, the curriculum encourages knowledge in the learners' local contexts, while being considerate to global obligations. The researcher's main aim of verifying the availability of this policy statement was to establish whether all the participants were having it and also if they are capable of interpreting the policy statements. The researcher established that all the participants from the sampled schools do have the policy statements and they were capable of interpreting the policy statements. To support the above, DBE (2011) made public that, NCS is based on the following values namely: societal change, effective and analytical

learning, both elevated awareness and abilities, advancement, human rights, inclusivity, ecological and social fairness, respecting ethnic awareness practices and credibility, worthiness and proficiency.

- **Teachers' work-schedules:** A work schedule is a planned sequence (schedule) in which work is going to be covered by the individual teacher. This is achieved via the teaching plan per term for each grade. The content indicated within the teaching plan for the term is the minimum content that must be covered in that particular term. A work schedule comes into play when the teacher needs to identify the sequence in which he/she is going to cover the content identified in the teaching plan and it is fixed in the CAPS. The researcher in this study wanted to verify from all the participants whether they were supplied with the relevant work schedules for grade 2 mathematics. Furthermore, the researcher wanted to establish whether all the participants complied with the prescribed work content as it appears in the work schedule. The findings were as follows: teacher Mpho displayed challenges with proper compliance to the work-schedule resulting from lack of pedagogical content knowledge in mathematics; teacher Lerato complied fully with the administration of the work-schedule, while teacher Pheladi experienced challenges in complying with the work-schedule due to multi-grade teaching in her classroom. To support the above analysis, Mutton, Hagger & Burn (2011) revealed that knowledge of how to strategise is much-admired as a crucial proficiency that teachers have to acquire because it is only through planning that teachers are capable to learn about teaching and through teaching that they are able to learn about planning.
- **Lesson plans:** A lesson plan is a teacher's comprehensive description of the sequence of instruction or learning trajectory for a lesson. A daily lesson plan is developed by the teacher to guide classroom learning and its details will differ subject to the preference of the teacher, the topic to be covered, and the demands of the learners. There may be requirements mandated by the school system regarding the plan. Therefore a lesson plan is the teacher's route-map for running a particular lesson, and it includes the goal (what the learners are supposed to learn), how the goal will be reached (the method, procedure) and a way of measuring how well the goal was reached such worksheet, class work,

homework, test, etc. The researcher in this study wanted to establish whether the participants' lesson plans were properly planned and grade appropriate. The researcher found that all the participants' lesson plans were properly planned; grade appropriate and were corresponding with the supplied work-schedules. Lastly the researcher wanted to check whether the lesson plans were quality assured by the departmental heads (DHs) prior to administration. It was established that, even though the lesson plans were grade appropriate and in line with their work schedule, there was no evidence of quality assurance by DHs of participants' lesson plans prior administration to the learners. To support the above analysis, Vdovina and Gaibisso (2013) revealed that certainly, writing a lesson plan assists to arrange the teachers' ideas and ensure an outline that denotes how to take our learners to guaranteed "learning destinations". In order to 'develop plans that include the development of critical thinking some essential elements or components are typical for any lesson plans, yet some other components need to be added and adapted in order to integrate a critical thinking element' (Vdovina & Gaibisso, 2013: 58).

- **Learners' rainbow workbooks:** Rainbow workbooks form part of the Department of Basic Education (DBE)'s choice of strategies which is intended at recuperating the performance of South African learners in the first six grades of schooling. As one of the priorities of the government's plan of action, this project has been made possible by the generous funding of the National Treasury which has qualified the department to make these workbooks, in all the official languages, available at no cost. The department's intentions about these workbooks is that teachers will find these workbooks valuable in their everyday teaching and in certifying that their learners cover the curriculum. The department has further taken care to guide the teacher through each of the activities by the inclusion of icons that indicate what it is that the learner should do. The researcher's main aim in analysing this rainbow workbooks was to confirm whether all learners had workbooks and if the teachers were utilising them efficiently. The researcher discovered that, in all the sampled schools, all the learners had workbooks. The challenge that was established from this workbooks was that, not all teachers were utilising these workbooks as expected by the DBE. From the sampled participants, teacher Mpho was the only one who utilised the rainbow workbooks on daily basis based on the topic that was taught for that

day. Both teacher Lerato and teacher Pheladi relied mainly on utilising an exercise book and they didn't give learners much work in the rainbow workbooks that were supplied by the department. Another challenge that was identified by the researcher was that learners couldn't partition the circular representations properly. To support the above analysis, the DBE workbooks that have been delivered to various schools in the country consist of 128 discrete worksheets, four worksheets per week and eight weeks per term (DBE, 2011) and granted the scale and cost of this intervention, the provision of workbooks is clearly central to the South African government's strategy to improve learning outcomes in public schools with literacy/language and numeracy/mathematics (Fleisch, Taylor, Herholdt & Sapire, 2011).

- **Grade 2 mathematics - Subject Improvement Plan (SIP):** This serves as a reference document that can assist relevant role players to plan, organise and implement subject specific activities in order to improve learner attainment and further improve the quality of passes in a particular subject. The subject improvement plan will always be utilised by the teachers, the departmental head and curriculum advisors to track subject improvement on continuous basis throughout the academic year. In this reference document, the researcher wanted to establish how the sampled teachers were planning to improve mathematics performance, with special reference to fractions teaching in grade 2. The researcher discovered that none of the sampled participants had developed a SIP for grade 2 mathematics. To support the above analysis, Reddy and van Rensburg (2011) contended that given SA's plan for economic competitiveness, this is an investment we need to construct yet the fault we are creating is to take for granted that it would happen on its own, however the outcomes have displayed that it does not and for this reason we should embrace achievement targets for better-resourced schools as well and we need to establish distinguished goals for the two parts of our educational system by designing specific strategies for each part of the system because neither of the parts is performing at the obligatory levels.
- **Item analysis reports:** The item analysis report affords the teacher with numerical analysis on specific types of questions used on an assessment, including question performance, question descriptions, answer choice text,

response frequencies, discrimination index, and overall performance history to enable the teachers to improve their question creation process. The item analysis report is mainly used only on hot spot questions such as fractions questions in mathematics, multiple choice, true/false, matching questions, and it cannot provide such information for essay type questions. In these reports, the researcher wanted to verify whether teachers were conducting item analysis after every assessment task was administered to grade 2 learners in mathematics. The conclusion reached was that none of the sampled teachers conducted item analysis post administering of assessment tasks to their learners. Additionally, the researcher wanted to clarify the availability of proper intervention strategies in the case of poor performance in each question administered pertaining to fractions. It was established that none of the sampled teachers had developed proper intervention strategies pertaining to fractions teaching in grade 2. To support the above analysis, item analysis employs piece of data and skilful adjudication to assess tests based on the quality of individual items, item sets, and entire sets of items, as well as the relationship of each item to other items and it further explores the performance of items considered individually either in relation to some external criterion or in relation to the remaining items on the test, however it employs this evidence to improve item and test quality (McCowan & McCowan, 1999).

- **Minutes of grade meetings addressing the teaching of fractions:** This is the written record of meetings, particularly for grade 2 teachers that are kept by the secretary. The aim of the researcher in verifying this records was to establish whether teachers had a platform to discuss the challenges they encountered when teaching mathematics and fractions in particular in grade 2 and also check if the teachers are implementating the strategies that are taken as resolutions during such meetings in order to improve fractions performance in the classroom. It was confirmed that all the participants did not have a platform to discuss the challenges encountered when teaching fractions in grade 2 since all the schools sampled had only one class for grade 2. An additional purpose was to check for evidence of implementation of resolutions taken during such meetings and no evidence was found of the implementation of resolutions taken during grade meetings because such meetings were not held at all the sampled schools. To support the above analysis, Graham (2007) revealed that when teachers work

jointly to develop programmes that demarcates the fundamental knowledge and skills each learner is to obtain, when they develop regular common assessments to monitor each learner's erudition on a frequently, when they collectively scrutinise results from those assessments to establish strengths and weaknesses, and when they assist each other to develop and implement strategies to improve current levels of their learners' learning, they are commissioned in the genre of professional development that fabricates teacher capacity and maintains school improvement.

- **Minutes of parent-teacher consultation meetings:** This is a short meeting between the parents and teachers of learners to discuss a child's progress at school and find solutions to academic or behavioral problems. Parent-teacher consultation meetings augment the information conveyed by academic report cards in such a way that they focus on the learners' specific strengths and weaknesses in individual subjects and generalising the level of inter-curricular skills and competences. Most of these meetings are held in the absence of the learners whose progress is being discussed, although there is evidence that their inclusion increases the productivity of the meetings. Parent-teacher consultative meetings usually take place once every school term, although some schools organise only one meeting during (mostly at the beginning of) the school year and the meetings are generally led by teachers who take a more active role in information sharing, with parents relegated mostly to the role of listeners. The researcher's intention with these records was to establish the parents' responses when invited for consultative meetings and further establish how parents intended to assist their children at home. The researcher then established from all the sampled participants that no parent-teacher consultation meetings were held. To support the above analysis, Guo (2010) revealed that teachers may utilise the parent-teacher consultative events as occasions to create a quick relationship with the learners' parents and explain the subject syllabi and class rules and further refer to them as events where parents, teachers, and sometimes learners meet to discuss the learner's progress.
- **Class visits and/or support programmes reports findings:** These are the reports of the findings that are established by the SMT preferably the DH, about what transpires in a classroom when a teacher is presenting a particular subject

and preferably fractions in this case. The researcher therefore wanted to establish whether the School Management Team (SMT) conducted class visits and how often those class visits were conducted; and to further ascertain whether the SMTs do offer support programmes to the teachers, particularly in mathematics grade 2 with special reference to fractions teaching. The researcher established that there were class visits schedules to be conducted support programmes to the teachers on a quarterly basis at all the sampled schools however, the implementation of those schedules was a bit slow sighting reasons of lack of time due to numerous disruptions as a result of teacher memorial services and workshops that are conducted during teacher-learner contact time. To support the above analyses (Mestry, Hendricks & Bisschoff, 2009; Mnisi; 2016) argued that class visits should be prioritised for teacher professional growth and they should be positioned high on a school's itinerary otherwise the teachers' professional growth could be completely jeopardised if class visits are not conducted since there is evidence that they are not yet been effectively executed in some provinces, while in others, execution is very sluggish.

- **Monthly written work output:** This is the total number of assessments that are administered by the sampled teachers to their learners to write in mathematics with special reference to fractions. The researcher's aim of getting the overall number of written work per month was to verify whether teachers were complying with the expected number of written work specified for a month and also to validate whether the written work was properly marked as per the given instructions. The researcher discovered that all the participating teachers were not able to comply with the expected number of written work output specified for a month due to contact time disruptions that were often encountered and also it was verified from teacher Mpho's marking that she was the only teacher who did not mark the written work as per the given instructions. Classroom assessments emerges to be one of the most powerful forces that manipulates education in the sense that it influences learners in countless several ways such that it influences learners adjudication of what is imperative to learn, it influences their instinct and self-perceptions of competence, it configures their approaches to and timing of personal study, it strengthens learning, and affects the improvement of lasting learning strategies and skills and as a result, it warrants very careful preparation and substantial amount of time from teachers (Crooks, 2001).

- **Evidence of catch-up programmes that were conducted in case of lost contact time:** A Catch Up Programme is an intervention plan designed for learners who are behind with their school work. To check whether the sampled teachers offered catch-up programmes for the time lost as a result of their absence from work. The researcher confirmed that there was no evidence of catch-up programmes being administered to grade 2 learners in all the sampled schools. To support the importance of these programmes in teaching, Gorard, Siddiqui and See (2015) revealed that catch-up programmes are instructive interventions envisioned for learners who are struggling to accomplish what is legitimately considered to be their age appropriate levels in a particular topic. These programmes are crucial because struggling learners are more likely to remain behind, or fall further behind, their classmates, which can also lead to other issues such as disruptive classroom behaviour (Gorard, et.al 2015).
- **Monitoring tools for quality assurance of assessment tasks:** These are the tools for monitoring the process aimed at determining or evaluating the quality of standards of assessment tasks that are administered by the teachers at school. Quality assurance is a process aimed at establishing and maintaining structures and procedures that will result in quality standards, products and processes. The main aim of going through this tool was to determine whether the DHs in the foundation phase conduct moderation of assessment tasks prior and post administration of tasks by the teachers. The researcher established from all the sampled schools that all assessment tasks were moderated prior and post their administration to the learners. The only challenge identified was the fact that teachers did not cover all the cognitive levels when setting tasks. To reinforce the above analyses Doyle (1988) contended that the assessment tasks that teachers assign governs how learners turn up to comprehend the curriculum domain in the sense that assessment tasks serve as a background for learners' theory during and after the assessment has been administered.
- **Learner daily attendance registers:** Learner Attendance registers confirms that daily records of learner attendance are kept to enable schools to monitor learner absence and take appropriate action with both the learner and the parents. Learner attendance records enable district offices to track attendance trends in schools and to respond appropriately with relevant intervention programmes.

Records of learner attendance may be required for legal purposes. It is therefore essential that schools keep and maintain such records accurately. The main aim of the researcher to go through the learner attendance registers was to verify whether learner daily attendance registers were marked properly; and to establish the rate at which learners are absenting themselves from school and if parents do give reasons for their children's absenteeism. In all the sampled schools, learner daily attendance registers were properly marked on a daily basis and the researcher established high rate of learner absenteeism without valid reasons from parents. To support the above analyses, Bedi and Marshall (2002) revealed that minimal levels of school attendance may be liable for low academic attainment, which in turn, is linked to high repetition and desertion rates.

- **Teacher movement registers:** This is a document wherein the teachers' movement that occurs at a school prior time off is recorded. The register normally comprises of the name of the school; date of movement; name of teacher; persal number; time in and time out; purpose/place of visit; person authorising the trip and the signature of the teacher concerned. The researcher's main aim of looking into the movement register was to ascertain the type of trips that are normally authorised for grade 2 teachers to undertake. The researcher established that most of the participants' trips that were authorised by the SMTs in all the sampled schools were for attending memorial services of other teacher and for attending workshops. The researcher further established that the teacher memorial services usually started at 12h00 and the commencement time for workshops normally vary, some starts at 9h00 while others starts at 12h00. This is an indication that, the trips that were taken by teachers disrupted the expected contact time of learners and teachers. The researcher then inquired from the participants if there were any catch-up programmes that were done to replace the lost contact time, and the researcher established from all participants that catch-up programmes were not administered with their learners to cover the time lost. Finlayson (2009) revealed that when a teacher is absent from the classroom, learners learning is interrupted.
- **Teachers' leave register:** It is a document that records the regularity of teachers' attending school in a circle of three years. Teachers regularly sign this register as proof of their presence at school. The register displays the number

and nature of leave taken by teachers which include family responsibility leaves, sick leaves, leave without pay, professional leave, etc. The researcher's aim of looking into the teachers' leave register was to validate the type of leaves that the teacher is taking and how often such leaves are taken. In all the sampled schools the researcher confirmed that the teachers' leave registers were available and updated on regular basis by the school principals. In addition, records of teachers' absenteeism were properly kept, where all teachers were required to sign for their leave of absence on submission of leave forms. Furthermore, the researcher established from the sampled participants that teacher Mpho displayed a pattern of absenteeism due to ill health, the leaves were normally taken immediately after pay day. Teacher Lerato's leave was for professional development and it was taken only once since a circle of three years has started. Teacher Pheladi didn't have any leave taken. To support the above analysis Finlayson (2009) argued that when a teacher is repeatedly absent, learners performance can be significantly impacted in a negative way and the more days a teacher is out of the classroom, the lower their learners tend to score on standardised assessments.

4.4. CLASSROOM OBSERVATIONS

Classroom observations have developed to be a fundamental part of research associated with mathematics education (Bostic, Lesseig, Sherman & Boston, 2019). These have been progressively exploited everywhere on the universe for an array of purposes namely, to understand and to improve teaching (Bell, C. Dobbelaer, Klette & Visscher, 2019). Classroom observation is therefore an purposeful, precise procedure that is planned and focused because it encompasses more than merely "seeing" only, instead it commands the maximum attention of the observer and the ability to properly record what has occurred in the observational setting (Roberson, 1998).

The following codes, as reflected in Table 4.4 below, were utilised by the researcher to analyse the acquired information that was displayed during classroom observation sessions in order to grasp more data that would be beneficial to the research topic.

TABLE 4.4: CODES FOR CLASSROOM OBSERVATION OF PARTICIPANTS

Code	Code description
COa#T-Mp	Classroom observation -Teacher Mpho
COa#T-Ph	Classroom observation-Teacher Pheladi
COa#T-Le	Classroom observation-Teacher Lerato

The data below emerged during classroom observation sessions and was therefore analysed as follows:

- **School attendance and punctuality:** COa#T-Le revealed that learner absenteeism was very high because out of 70 learners, 10 were absent without valid reasons. COa#T-Mp revealed that all learners were present and COa#T-Ph it was exposed that out of 110 learners, 15 were also absent without valid reasons. From the above analysis the researcher established from the two schools that were sampled that learners were not attending school regularly whereas in the case of teachers, all of them were attending school on regular basis. To support the above analysis, learner absenteeism can be interpreted as a deed of learner indiscipline which contests with or jeopardises certain school goals thus truncating school performance (Juliana, Arop & Lawrence, 2019). Furthermore, learner absenteeism tends to be a powerful indicator of the kind of adult that our school children turn out to be in future as well as the society these children live in and it frustrates the outcome of the Education for All (EFA) initiative (Juliana, et.al, 2019). Consequently, learner absenteeism presents considerable challenges to schools in their attempts to manage their daily occurrence effectively (Otto, 2016).
- **Class-size:** COa#T-Mp revealed that there were only 25 learners in a class whereas COa#T-Ph showed that there were 110 learners in a single class due to multigrade teaching that was happening at the school and COa#T-Le revealed that 70 grade 2 learners were allocated to one teacher. The researcher established that the teacher-learner ratio in two of the schools that were sampled was a challenge because one school was posing a challenge

of overcrowding in a single classroom whereas the other school had multi-grades wherein grade R-3 were combined into a school hall. Only one school had a minimal number of learners in a class whereby the teacher-learner ratio was beneficial to promote effective teaching and learning. To support the above analysis Khan and Iqbal (2012) highlighted that a classroom is said to be overcrowded in when the number of learners surpass the optimum level such that it causes hindrance in the teaching- learning process. Carlson (2000) reported that quality learning was not possible when large number of learners were crammed into small classrooms. Furthermore, Shah and Inamullah (2012) found from their reports that over-crowded classes could have a direct impact on learners' learning. They not only affected learners' performance but the teachers had to face various setbacks such as discipline, behavioral problems, poor health and poor performance of learners, put stress on teachers and increased in drop-out rate of learners.

- **Availability of teaching resources:** The lesson presentations that were observed revealed the following, teacher Mpho employed apples to demonstrate partitioning of circular representations to two people, teacher Pheladi also utilised oranges to exhibit partitioning of circular representations to two people whereas teacher Lerato used apples to teach how to partition circular representations amongst people. The researcher established from all the schools that concrete resources were utilised to teach fractions partitioning. The only challenge that was established was the resources were not enough in all the schools and also that the available resources were not properly utilised to promote effective teaching and learning of fractions partitioning because some learners did not have chance to see how those resources were partitioned due to overcrowdedness in the classroom. Only those that are seated at the front could see what the teacher was doing. To support the above analysis, Nzomo (2011) revealed when choosing the learning resources to be utilised, it is imperative to value the critical role that is portrayed by these learning resources in the teaching and learning process and make it a norm to properly select and employ learning resources frequently and occasionally during the teaching and learning sessions.

- Classroom management:** The researcher established from COa#T-Mp that it was the only school where the number of learners in a class was minimal and also that teacher Mpho was capable of controlling learners' disruptive behaviour during the lesson presentation and there were no peripheral conversations and other interferences to disrupt the learning activity from the learners. The researcher further established from COa#T-Ph and COa#T-Le that the high number of learners that the teachers were faced with in the classrooms was a serious challenge which resulted into disruptive behaviours, peripheral conversations and other interferences that disrupted the learning activity. However, set of clear established classroom rules were noted from all the schools that were sampled. The above analysis is corroborated by Ehrenberg, Brewer, Gamoran and Willms (2001) when arguing that the number of learners in a class has a latent affect on how much is learned in various ways in the sense that it can alter how learners work together and also the degree of social engagement may result in more or less noise or disruptive behaviour which in turn can have an effect on the nature of activities the teacher is able to disseminate.
- Addressing barriers:** The researcher established from COa#T-Ph and COa#T-Le that teacher Pheladi and teacher Lerato were struggling to address learner barriers due to the high number of learners in their classrooms. This hampered effective teaching and learning for fractions partitioning. Learning barriers that were identified by the researcher from both observations were: some learners sleeping while the teacher is busy presenting the lesson and this may be caused by the fact that the learners were sick and the teachers couldn't realise that because of the large number of learners in a classroom, another barrier that was identified when observing teacher Lerato's class was that there were some learners who were busy teasing other learners while the teacher is presenting the lesson. From the COa#T-Mp, the researcher established that one of the learners couldn't respond to the teacher's questions and teacher Mpho further disclosed that the same learner is always quite even if it is during breaks when other learners are playing. The researcher then disclosed that all the sampled teachers were not capable of addressing learning barriers that their learners

are confronted with on daily basis. To support the above analysis, Basch (2011) contended that no matter how well teachers are ready to teach, no matter what answerability actions are put in place, no matter what leading structures are instituted for schools, educational advancement will be intensely limited if learners are not inspired and able to learn yet certain health hindrances also play a major role in limiting the motivation of the learners and their capability to learn (Basch, 2011). Consequently, the reduction of these disparities through a coordinated approach warrants validation as a cohesive school improvement initiative to close the achievement gap.

- **Curriculum implementation:** Lesson plans for all the sampled participants were prepared in line with the workschedule. Teacher Mpho was the only one who displayed challenges with preparation of lesson plans and tasks for fraction partitioning, however all the lesson plans were not quality assured by their departmental heads. Teaching aids that were utilised during classroom observations were as follows: All the teachers used various fruit like apples and apples to teach partitioning of circular representations amongst two people, and when they gave learners assessment tasks teacher Pheladi asked learners to shade a clock into two parts whereas teacher Lerato and teacher Mpho asked learners to partition a circle amongst three people. The learners' responses were displayed in Figures 2 to 4 below in the next section on semi-structured interviews. Furthermore, teacher Mpho's learners were the only group who managed to interact with one another during the lesson presentation. The researcher spotted a challenge in all the schools that were sampled because teachers did not indicate to the learners that when partitioning fractions they must ensure that the partitioned spaces must always be equal hence the learners were able to partition the whole according to the numbers that were given by the their teachers but not making sure that the partitioned spaces are equal. Teacher Lerato and teacher Mpho's assessment tasks were a bit frustrating to their learners because they were shown an example on partitioning a fruit amongst two people yet when they were given an assessment task, the teachers then expected the learners to partition a circle amongst three people. To support the above analysis, Johnson (2007) asserted that authentic assessment with flawless standards and criteria for merit should involve real-life tasks, performances, or

challenges that mirror those faced by learners. In addition, Darma, Candiasa, Sadia and Dantes (2018) revealed that assessment does not only entail the questioning or extracting the knowledge that the learners have known, it needs learners to display the actual occurrence about knowledge that has been comprehended and grasped.

- **Providing feedback:** The researcher established during classroom observations that learners' workbooks were controlled on regular basis, however it was revealed from teacher Mpho's marking that learners were sometimes credited for the incorrect responses as it appears in **Figure 1** in the next section of semi-structured interviews. To support the above analysis Hattie and Timperley (2007) argued that learner feedback is one of the most influential guidance on learning and achievement because feedback which is correctly composed and individually tailored to the learners' work enhances learners' achievement across subjects and grades (Brookhart, 2017).

4.5. SEMI-STRUCTURED INTERVIEWS

Although semi-structured interviews are used widely in research, inadequate courtesy is given to their miscellany, fundamental expectations, structure, and comprehensive claims to qualitative research (McIntosh & Morse, 2015). The following themes emerged from the data collected during the semi-structured interviews, namely: demographic variables that hamper proper teaching and learning of fractions; approaches employed when teaching fractions; theories of learning that are drawn on during the employment of the teaching approaches; challenges experienced when teaching fractions, and aspects of fractions that are most problematic to learners. Below is a transcription of the participants' responses and the way the themes that emerged during the study were analysed.

4.5.1. Theme 1: Demographic variables that hampers proper teaching

The theme emerged from question 3 on the interview schedule (**Appendix: D**), where the researcher envisioned to deduce from the participants whether there were any demographic variables that they normally encounter that may hamper proper

teaching and learning of fractions. The transcriptions below present the responses from the participants in this study.

#T-Mp: *“Most of my learners are from child-headed families and as such they don’t get the maximum support from their parents because parents work far from home. Even if you ask learners to bring along concrete objects that can be used to teach them fractions easily they don’t bring them. The other thing that hampers proper teaching and learning of fractions is the high rate of learner absenteeism without valid reasons. Erh... these are the demographic variables that I normally encounter and it is quite a challenge because even if I call their elder brothers or sisters to come to school in order to discuss with them some issues, since their parents are working far from home, they don’t come”.*

#T-Ph: *“Demographic variables that hamper teaching and learning of fractions that I noticed include among others poor parental involvement especially when they are called to school for parent consultative meetings. Again, high rate of burglary that occurs in our schools which is caused by high rate of unemployment in the community is also a contributing factor. In most cases, when burglary occurred at school, there is a lot of vandalism that takes place because you find that those criminals go to an extent of tearing learner books and other teaching aids that you have prepared as a teacher”. The other factor is the issue of teacher time-offs due to memorial services that takes place during learner contact time”.*

#T-Le: *“This is a very serious challenge because there is high rate of parent unemployment whereby parents cannot afford to provide their children with household things that are needed to enhance proper teaching and learning of fractions. Another challenge is lack of parental involvement in their children’s education because some learners are staying with their grandparents who are not aware of whether these children are coming to school or not”.*

The researcher established from all the participants when conducting interview sessions that most of the learners lack parental support because they are from child-headed families due to parents who are migrant workers. In addition, some parents

do not avail themselves when they are summoned for parent consultative meetings. Furthermore, some children stay with their grandparents, who are not even aware of whether these children are coming to school or not. To support the above analysis parents have a vital obligation to ensure that their children are at school on a daily basis, since they are the only safety nets to their children yet it is disappointing to note that majority of parents do not execute this imperative reality. (Demir & Akman Karabeyoglu, 2016; Modisaotsile, 2012).

Also the researcher established that a high rate of learner absenteeism occurs at schools, without valid reasons being provided which hampers proper teaching and learning of fractions by these teachers, additionally the researcher confirmed from the participants in this study that, there is lack of parental support to some of these learners. To support the above analysis, Mbugua, Kibet, Muthaa and Nkonke (2012) argued that the point at which parents or other family members are keenly entangled in a learner's education, nurtured a progressive impact on the learner's attainment. The researcher further established during the interview process that there is high rate of unemployment among parents which hampered proper teaching and learning of fractions in the sense that unemployed parents are unable to provide their children with the household items that were requested by the teachers to administer fractions teaching using real objects, the high unemployment rate therefore resulted in the high rate of burglary that bothers most of the schools in the circuit wherein the burglary that is occurring at the schools is accompanied by huge vandalism whereby criminals go to the extent of tearing learner books and other useful learner support materials that are employed when teaching fractions to these learners. As a result, the teaching of fractions tends to be hampered in one way or another. To support the above assertion, Pryor & Paris (2005) emphasised that, majority of the youth take to crime because of hardship and poverty, which propels them to become hooked on criminal deeds for continued existence.

Teacher Pheladi also revealed during the interviews that, in most cases, periods are forfeited due to memorial services that take place during learner contact time. This activity hampers proper teaching and learning of fractions because these memorial services take place from 12h00 on most Thursdays. The researcher also found, during document analysis that time offs in the teacher movement registers appeared

on numerous occasions in a single month. To emphasize the above, a press release by the National Professional Teachers' Organisation of South Africa (NAPTOSA, 2018) revealed that some teacher unions in South Africa conduct their mass meetings and memorial services during learner contact time. The learners are not only deprived of their contact time, but their well-being is exposed to danger or disgrace when they are sent home without their parents being adequately informed (NAPTOSA, 2018). Furthermore, Kenny (2018) noted that the latest inquiry among underprivileged schools in South Africa disclosed that majority of primary school teachers are not capable of detecting the major concept in a modest passage of text, or able to perform straightforward mathematical calculations; yet they took much time off teaching to attend workshops, union meetings, memorial services and choir competitions.

In all the schools that were sampled for the study, the researcher also analysed both the teacher leave register and the learner attendance registers. The researcher established from these documentations that, teacher and learner attendance did not correspond to each other. All the teachers whom were observed for this research attended school on regular basis as per the records in their leave registers, whereas some learners did not attend school regularly and, most worryingly, reasons were not furnished for their absence. Aden et al. (2013) highlighted the importance of regular school attendance because learners are more likely to achieve in their studies when they concentrate on attending school on regular basis.

The researcher further observed both learner and teacher punctuality in the morning when they came to school. It was noted that teachers often arrive fifteen minutes before the school starting time, whereas some learners arrive late during first period. This was observed for three weeks in succession and the pattern remained unchanged. In most cases the same learners would arrive late on daily basis. Oghuvbu (2010) highlighted the fact that the rationale for establishing a school is mainly to bring learners from various families together under one roof, the classroom, since effective teaching and learning can only take place in the presence of the teacher and the learners. Scott (2016) argued that primary school learners who are routinely tardy develop difficulties with discharging and grasping the given

procedures. Tardiness can disrupt a learner's whole morning, or even their day, since morning procedures are indispensable to their daily lessons (Scott, 2016). Regarding the rate of punctuality in attending class, both learners and teachers always arrived punctually in their classrooms after break intervals.

4.5.2. Theme 2: Approaches employed when teaching fractions

The theme was developed from question 4 and 5 on the interview schedule, where the researcher intended to deduce the approaches that the participants normally employed when teaching fractions to their learners and the reasons for utilising those approaches. The transcriptions below presented the responses from the participants in this study.

#T-Mp: *"The approach that I use is that of teaching the whole group at once- showing them examples on the chalkboard and thereafter employ the question and answer method wherein learners are asked questions based on what I have taught them and thereafter I make sure that they get involved by doing answers on the board in front of other learners. I prefer using this method because when learners are involved they learn better and faster".*

#T-Ph: *"I normally group learners and make sure that I mix the slow, average and high performing learners in one group so that they can assist one another and I always make sure that they use real objects during my teachings so that learners can touch and feel them. This role playing method is working for me because learners assist each other and they become active during the lesson presentation".*

#T-Le: *"Since my class is over-crowded, I am unable to teach them in groups instead I teach them as a whole group and ensure that I demonstrate my teaching using real objects. Thereafter these learners are also given chance to touch and feel the real objects utilised during my teachings and I make sure that I engage the whole class by giving them more activities where they can assist one another to get the answers through role playing. I use this method because it gives learners chance to get involved in the lesson itself".*

The researcher established from the participants' responses that, learner-centred approach and role-playing methods are mainly employed in all the schools that were sampled in order to facilitate teaching, since all the participants indicated that they prefer involving their learners when teaching fractions even though only one participant did not say anything about using concrete objects.

To support the above analysis Achilles (1996) highlighted that learning that is appealing and inspiring to learners should become a lively activity, in which all the learners are deeply immersed; and steered through the employment of a diversity of teaching methods. This approach will in the end, present learners with a diversity of learning opportunities, permitting them to take a broad view and categorise information in the near future (Shah & Inamullah, 2009)

4.5.3. Theme 3: Theories of learning that are drawn during fractions teaching

The theme above arose from question 6 on the interview schedule, since the researcher intended to deduce from the participants' perception whether there were any philosophies of learning that were drawn upon with respect to the employment of the teaching approaches that the participants normally utilise when teaching fractions to their learners. The following responses were obtained from the participants when answering the question.

#T-Mp: *"I normally teach fractions starting with what the learners already then gradually introduce the new content and I use real objects when teaching fractions because it becomes easier for learners to understand the topic when real objects are utilised- they can share easily".*

#T-Ph: *"I rely mainly on what learners know then introduce the new topic and make sure that learners are guided through in order for them to grasp the new subject matter or topic, moreover that our learners already know how to share things hence fractions is all about sharing in grade 2, and I therefore ensure that these learners use various real objects when teaching fractions to the learners".*

#T-Le: *“I normally make use of real objects and the things that the learners know and can see in order to understand and share fractions properly.*

During this study all the participants affirmed that they employed real life objects when teaching fractions because it becomes easier for the learners to learn while sharing these objects during the lesson. They also indicated that they rely on what learners already know when introducing the lesson. To support the above analysis, the researcher confirmed that teachers use the ZPD as a theory of leaning to design learning activities based on the learners’ prior knowledge to link the already existing knowledge with knowledge that they can perform with assistance, by so doing teachers will be scaffolding the learner to bridge the gap between what a learner can do independently and what a learner can do with assistance, (Siyepu, 2013). Reys, Lindquist, Lambdin and Smith (2014) also supports the researcher’s analysis by arguing that new discoveries should be planned in such a way that children can accomplish tasks without teachers assistance and allow for more distinctive choice while operating with dispensed objects. Therefore, teachers should be capable of viewing these frolic moments as appropriate chances to spot their learners from a unique viewpoint (Affine, 2012).

4.5.4. Theme 4: Challenges experienced when teaching fractions

Question 7 on the interview schedule gave rise to the above theme. The researcher intended to explore the challenges that participants normally experience when teaching fractions to grade 2 learners. The transcriptions below indicated the participants’ responses pertaining to the said question.

#T-Mp: *“As I have already indicated that I never majored in mathematics and foundation phase teaching, it becomes a bit of a challenge to me to teach fractions even though it is at a small scale because I don’t have a background of mathematics. So, I am not sure if I am on the right track or not. Another challenge that I am faced with when teaching fractions is that, our education system is encouraging inclusivity at schools yet teachers who are supposed to ensure implementation thereof are just microwaved with inclusive education and when we*

come back to schools after the workshop we don't know where to start when identifying learners with barriers. This is a very huge challenge that I am faced with on daily basis. Again, the other challenge that I am encountering is that of learners who just sit there and not write the work when they are supposed to do so".

#T-Ph: *"My greatest challenge is the issue of multi-grade teaching as I am supposed to teach a large group of learners at once. I was never trained on multi-grade teaching more especially that I am having three grades under one roof. I therefore end up teaching one topic to the whole group starting from grade 1 to 3 because when I focus on one group the remaining two groups starts playing and it becomes disruptive to the ones that I will be teaching. I also have a challenge of identifying learners with learning barriers and as a result the support that I am expected to give to these learners is minimal. Also, I am encountering serious challenges because I don't manage to cover the syllabi as expected in all the three grades".*

Teacher Mpho revealed that, since she did not major in mathematics, her lack of mathematics pedagogical content knowledge posed a serious challenge for her when teaching the subject. It can, therefore, be contended that pedagogical content knowledge (PCK) is expected to have the strongest links to actual teaching, as well as to unswervingly inspire a teacher's aptitude to present the curriculum correctly (Shepherd, 2013). Furthermore, Shulman (1987) remarked that an individual who takes the responsibility of becoming a teacher must, in the first instance, display knowledge in the discipline before being capable of assisting learners to acquire knowledge with comprehension. During the classroom observation session, the researcher realised that, lack of conceptual knowledge of the subject was indeed a contributing factor because the teacher credited learners in their workbooks without checking what exactly the question entailed. The learner workbook below displays exactly what transpired when the teacher marked the class activity for that particular day.

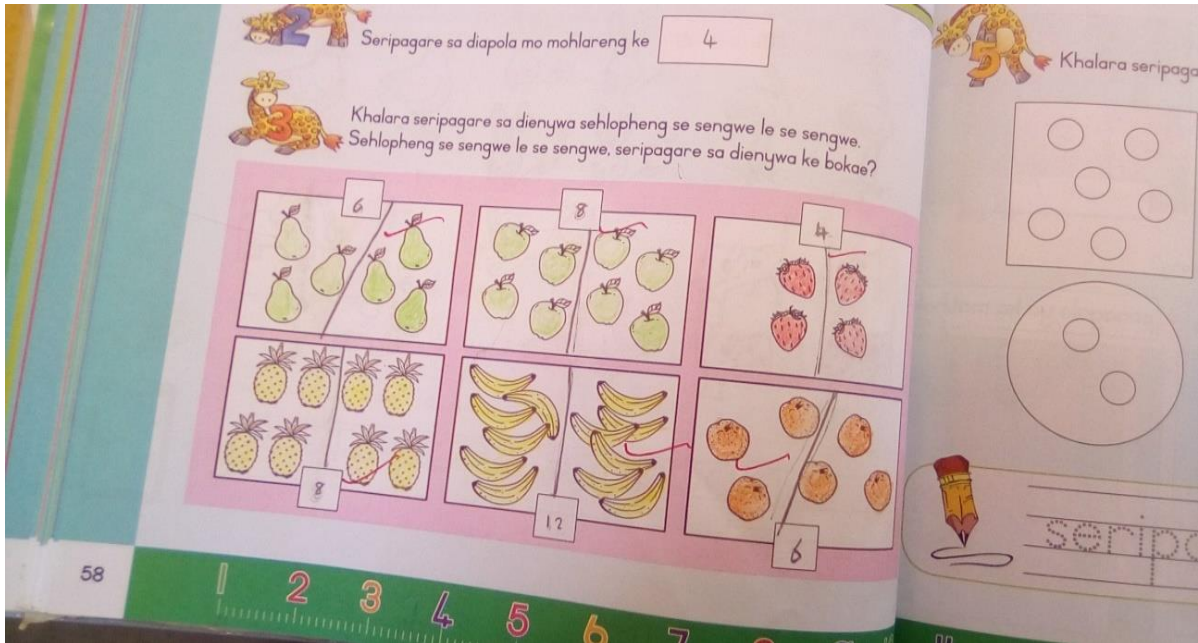


Figure 5: Evidence of marking from learner workbook

From the above illustration, the learner was supposed to shade half of the fruits in each box instead of shading all of the fruits. For example: in the first box there are six pears and only three were supposed to be shaded. The learner was supposed to write 3 as an answer in the box above. Instead, all the fruits were shaded and the learner wrote 6 in the box above as an answer. Same mistake was made in all the questions. Green (2011) argued that decent education depends on the existence of suitable teachers who are completely competent in the subject matter that must be instilled in the learners, and who also have comprehensive knowledge of the numerous tactics in which knowledge can be acquired. The National Research Council (NRC, 2001) also revealed that teachers are far-fetched to deliver sufficient explanation of theories that they do not comprehend, and that they can barely involve their learners in creative talks about numerous techniques to elucidate a problem if they themselves can only solve it in a particular way.

Another challenge that both teacher Mpho and teacher Pheledi alluded to above when teaching fractions is that, they become frustrated when they are expected to implementing inclusive education in their classroom contexts. Mahlo (2017) argued that, countless teachers in the teaching profession have not had the advantage of being guided on how to instil knowledge to learners with various needs and as a

result, find it challenging to unearth the needs of learners with learning barriers. Teacher Mpho and teacher Pheladi further revealed that, since they do not have inclusive education background, they face serious challenges when they are supposed to identify and give adequate support to learners with learning barriers. Dalton, Mackenzie & Kahonde (2012) deduced in their research that, deficiency of teacher abilities in accommodating distinct learning needs in the classroom may impede development in the attainment of inclusive education in schools. Furthermore, the principal objective of NCS grades R - 12 is to cater learners with acquaintance, competences and ethics that are essential for self-contentment, and profound participation in society as inhabitants of a free realm, regardless of their socio-economic milieu, ethnic group, sexual category, physical aptitude or talent, (DBE, 2011). Therefore, to educate learners with multifarious needs can be a challenge to most of the teachers however; inclusive education (IE) policy in South Africa requires all the teachers to be able to cater for diversity in their respective classes (Mahlo, 2017:1). The United Nations Educational, Scientific and Cultural Organization report (UNESCO, 2015) emphasised that multi-grade teachers need to initiate space for each group. UNESCO (2015) further reports that, this space is required in order to keep learners involved in various activities that are both profound and powerful enough so that nothing disturbs the learners from their work when dissimilar grades are assembled in the same class room, carrying out other activities at the same time; and in order to establish activities on which all learners can work – and assist each other with. It is also the teachers' obligations to concentrate on their aptitude to have all the learners stay focused on the work that they are involved in (UNESCO, 2015).

#T-Le: *“As you can see my class is over-crowded. I am teaching seventy-five learners in a class. So, I am not able to move around as you can see some of my learners do not have desks as they put their workbooks on the floor when they are writing”. Another challenge is that some of the learners do not write tasks as expected from them, some end up sleeping due to over-crowdedness more especially in summer when it is hot, some keep on playing while I am teaching.*

The above citation reveals that there are serious challenges with the issue of the class size. Teacher Pheladi could not cover the syllabi as expected because she has to teach one topic to the whole group within a multi-grade classroom in which learners from grade 1 to 3 are combined into one classroom and the teacher-learner ratio was 1:60. UNESCO (2004) revealed that multi-grade teachers are usually confronted with work challenges on daily basis when they are expected to deliver a curriculum intended for mono-grade classes. This challenge includes the situation when the teachers want to respond to diverse interests and abilities of the learners within their teaching space (UNESCO, 2004). As a result, the quality of teaching is compromised because multi-grade teachers are engaged in teaching more than one grade simultaneously, which further hampers proper teaching and learning. In addition, teacher Lerato's class is over-crowded due to lack of classrooms at school, with the teacher-learner ratio of 1:75. Therefore, teacher Lerato could not reach out to individual learners while teaching. This was supported by numerous investigations that demonstrate that, small class sizes allow teachers to devote more time to individual learners to ensure that specific learner needs are met (Isac, da Costa, Araújo, Calvo & Albergaria-Almeida, 2015).

4.5.5. Theme 5: Aspects of fractions that are problematic to learners

The theme above emerged from questions 8 and 9 of the interview schedule, the intention of which was to understand from the participants' point of view whether there were any aspects of fractions that were problematic to grade 2 learners. The question was posed to determine whether the problems encountered were the same in all the schools, or whether they varied from one school to another. The transcription below highlighted the participants' responds to this aspect.

#T-Mp: *“Most of the learners are have a challenge in dividing circular presentations. When they divide them the fraction parts that they arrive at are not equal especially when they are expected to divide to more than two people”.*

#T-Ph: *“The only problematic aspect that I have noticed with these learners is the inability to divide round shapes into equal parts more especially if the shape is to be divided amongst odd number of people e.g. three people”.*

#T-Le: *“One problematic aspect of fractions that I have observed with these learners is that, they cannot divide round figures properly in order to get equal parts, in most cases if they are supposed to divide a round figure into three equal parts, it becomes a challenge and they end up with unequal parts”.*

All the participants participating in this study signalled that their learners had a problem when they are expected to divide a circular representation among two or more people, ending up with uneven parts being shared among those people. From the participants' responses, the researcher established that partitioning of circular representations was a general problem amongst grade 2 learners.

Bruce et al. (2013) disclosed that spherical representations are hard to split evenly, commanding learners to concentrate more on the number of subsets and less on the congruency of compartments. This resulted in the learner uncertainty about whether compartments must be congruent or not (Bruce et al., 2013). Gould et al. (2006) uncovered the fact that, the majority of learners remained precise when colouring one half of the section of a circle, employing either a flat or a perpendicular contour to detach the circle into two equal parts. However, when these learners were probed to demonstrate one third and one sixth, an extensive array of inappropriate answers arose (Gould et al., 2006).

Figure 2 to Figure 4 below serves as a true reflection of what was observed by the researcher during classroom observations which supports that learners do experience challenges when they are required to partition circular representations amongst two or more people.

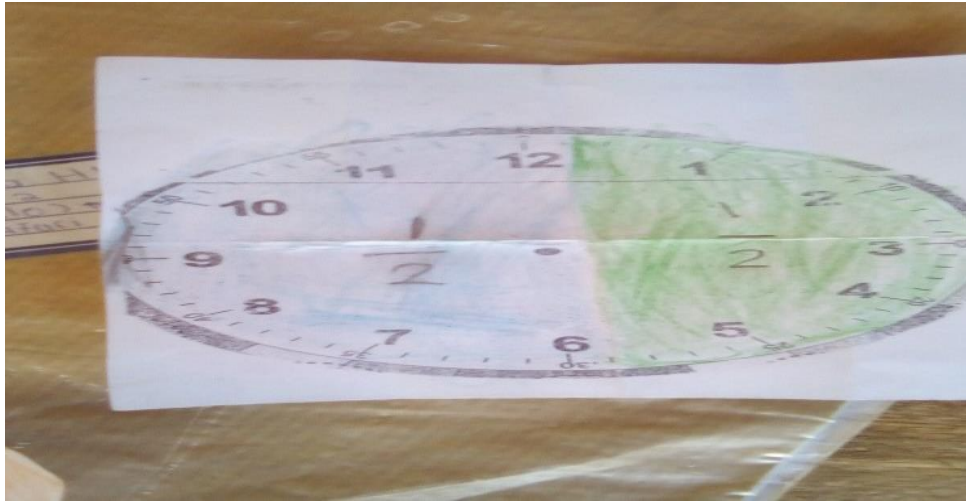


Figure 6: Partitioning of circular representation from teacher Pheladi's learner

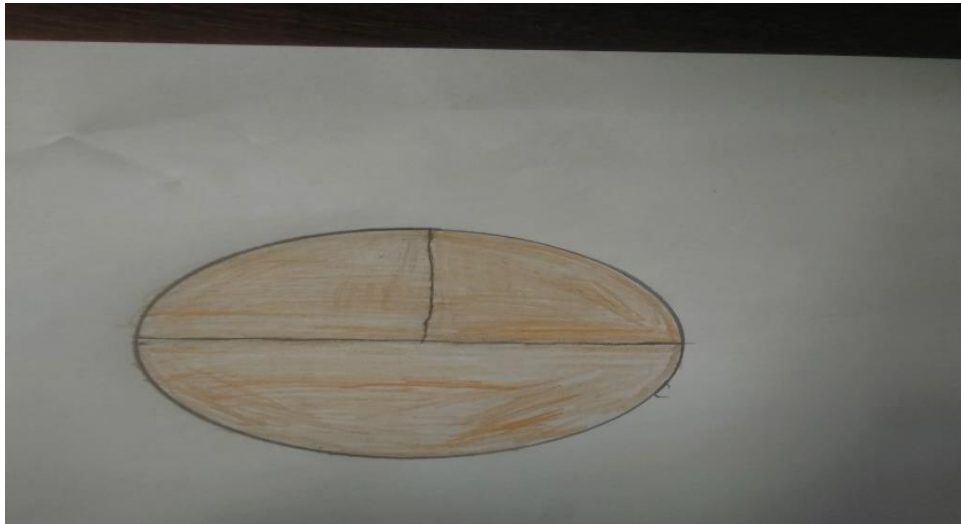


Figure 7: Partitioning of circular representation from teacher Mpho's learner

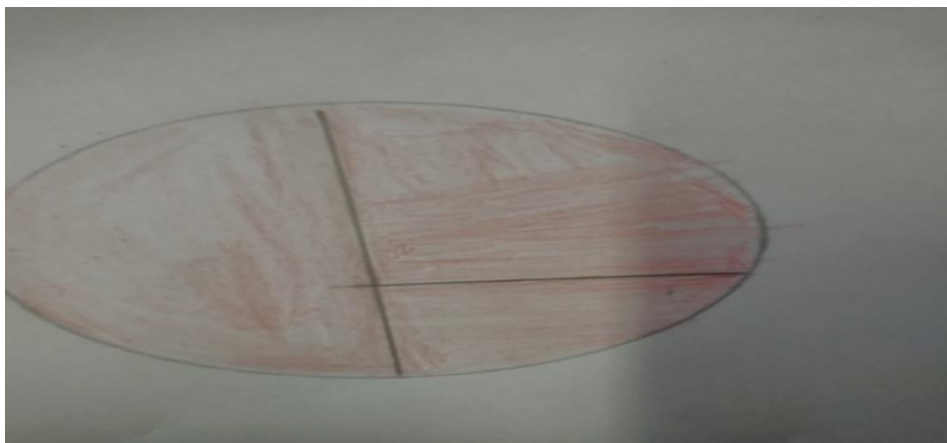


Figure 8: Partitioning of circular representation from teacher Lerato's learner

4.5.6. Theme 6: Teachers' content professional development programmes

Question 11 to 14 in the interview schedule addressed the above theme. The researcher wanted to establish whether participants had ever attended any content workshops that dealt specifically with the teaching of fractions. The researcher also aspired to determine how often such workshops were conducted. Furthermore, the researcher aspired to determine whether those workshops were useful for the teachers and, lastly, to make recommendations about the state of the conducted workshops. The transcriptions below present the participants' responses.

#T-Mp: *"I have never got the opportunity to attend any content related workshop. In most cases the workshops that are conducted focus more on checking of continuous assessment (CASS) and also on how to interpret the CAPS documents correctly. It is difficult to me to say whether the workshops were fruitful or not because I have already indicated that I have never attended such a workshop. I therefore recommend that our curriculum advisors presents us with more content workshops rather than work-shopping us on how to interpret policy documents each time we attend workshops. To me it becomes quite monotonous and time consuming because we can read and interpret policies on our own".*

#T-Ph: *"Yes, many workshops were conducted and of which I managed to attend without fail. To my disappointment, all the workshops that were conducted dealt much on interpretation of CAPS policies and also on what is expected of us when we submit CASS for moderation. For content workshops, I don't remember attending such and I therefore recommend that more of content workshops on various topics to be conducted and maybe only one on interpretation of CAPS documents in order to teach newly employed teachers in the system that are allocated grade 2.*

#T-Le: *"Every quarter we attend workshop but to my disappointment our curriculum advisors never workshop us on mathematics content. Instead they dwell much on CASS and interpretation of policy documents. Also, we are just microwaved during these workshops because a lot of work is expected to be covered in only one day or even some few hours as we use to attend from 12h00 when we are already tired".*

All the participants indicated that, even though they attend workshops, they never had the opportunity to attend content-workshops wherein fractions content and/or approaches on how to teach fractions was discussed. Instead, workshops on CASS moderation and interpretation of policy documents were mainly discussed during the workshops. Teacher Lerato also indicated that the workshops were conducted for short periods with a great deal of work to grasp. Teacher Mpho and teacher Pheladi further highlighted their desire that more of content workshops should be organised in order to assist them with how to approach some of the topics in the curriculum.

To support the responses above, Johnson (2000) revealed that professional workshops that are conducted for a minimal period are not adequate for essential career growth, especially in mathematics teaching. In view of the fact that there is direct interaction between the teachers and learners', including substantial control on curriculum application, it is realistically believed that augmenting teachers' knowledge, skills and attitudes is a positive move with respect to enhancing learner in mathematics (King & Newman, 2001; Ribisch, 1999). Meerah et al. (2010) noted that, in order to guarantee efficient curriculum application, teachers must be adequately trained, exceedingly determined, devoted and proficiently knowledgeable. Consequently, professional training of teachers remains a vital constituent for generating efficient schools and fostering learners' attainment in mathematics (Birman et.al.,2000; Rhodes & Houghton-Hill, 2000; Wood & Millichamp, 2000).

4.6. CONCLUSION

The aim of this chapter was to offer a far-reaching narrative of the participants' reactions with regard to challenges encountered when teaching fractions in grade 2 at schools in Koloti Circuit. The presentations and analysis of findings were focused mainly on document analysis, classroom observation and the semi-structured interviews whereby six themes emerged during the data analysis process as outlined in this chapter.

CHAPTER 5

RESEARCH FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

5.1. INTRODUCTION

Teachers are the major stalwarts of a sound and liberal society. For a society to become sincere; teachers should ensure that they extend knowledge, skills and values to our sons and daughters and groom these young ones for advanced education and future responsibilities (Motshekga, 2011).

As teachers play a vanguard role in the learner's ZPD, it is obligatory for them to have the required knowledge, skills and values to expedite learning in schools. This is particularly true since our learners come from diverse social classes, which presents challenges in the classroom situation. Consequently, it is a prerequisite for teachers to be acquainted with facts and practices needed to teach learners with diverse needs. They need to acquaint themselves as much as possible with the subject content and how to get this content across to learners.

In this chapter, the following are entailed as a concise description of what transpired during the entire research that led to the outcomes of this study, namely: the research design and method; summary of research findings; recommendations to the research study; limitations to the study and suggestions for future research. Below is a comprehensive summary of what transpired during the study.

5.2. RESEARCH DESIGN AND METHOD

Qualitative design was employed in order to administer the research with ease and the following study objectives were attained, namely; assessing the contextual knowledge of grade 2 teachers in the teaching of fractions with special reference to partitioning of circular representations; determining which theories were applied when fractions are taught; and establishing how fractions are taught to these learners.

Qualitative design was the preferred tool, in conjunction with interpretivist epistemology, to enable the researcher to view reality as subjective, differing from person to person (Scotland, 2012).

Thanh and Thanh (2015) maintain that interpretivist researchers unearth experience via participant's opinions, their own background and experiences, and to search for the participants' perceptions, an interpretive methodology offers a setting that permits the researcher to assess what the participants in his/her study have to say about their occurrences. During this study, the following findings which were spotted under the research methods enabled the researcher to achieve the objectives of the study.

5.3. SUMMARY OF RESEARCH FINDINGS

The researcher ensured a well-defined interpretation that justified the outcomes of the research inquiry solely for creation of bonds between the testaments acquired from the participants and the prevailing knowledge. After scrutinising the data underneath the themes that emerged from the interview schedule, as it appears in (**Appendix: D**), the following conclusions were drawn about the factors that contribute to challenges encountered by grade 2 teachers when teaching fractions.

5.3.1. Document analysis

When analysing documents some findings were established by the researcher that assisted in answering the postulated research question. Below are the findings that were established by the researcher during the analysis of documentations.

- **Foundation Phase Curriculum Assessment Policy Statements:** The researcher established that all the participants from the sampled schools do have the policy statements and they were capable of interpreting the policy statements.
- **Teachers' work-schedules:** The researcher established that two of the participants experienced challenges in complying to the work-schedule

because there was no evidence of proper compliance to the work-schedule resulting from lack of pedagogical content knowledge in mathematics while the other teacher experienced challenges in complying with the work-schedule due to multi-grade teaching in her classroom.

- **Lesson plans:** The researcher in this study established that all the sampled participants' lesson plans were properly planned and grade appropriate. Only one teacher's lesson plan did correspond with the supplied work-schedule. It was further established that even though the lesson plans were grade appropriate, there was no evidence of quality assurance by the DHs prior administration to the learners.
- **Learners' rainbow workbooks:** The researcher discovered that, in all the sampled schools, all the learners had rainbow workbooks. The challenge that was established from this workbooks was that, not all teachers were utilising these workbooks as expected by the DBE. From the sampled participants, only one participant utilised the rainbow workbook on daily basis based on the topic that was taught for that day. The remaining two participants relied mainly on utilising an exercise book and they didn't give learners much work in the rainbow workbooks that were supplied by the department. Another challenge that was identified by the researcher was that learners couldn't partition the circular representations properly.
- **Grade 2 mathematics - Subject Improvement Plan (SIP):** The researcher discovered that none of the sampled participants had developed a SIP for grade 2 mathematics.
- **Item analysis reports:** The conclusion reached by the researcher was that none of the sampled teachers conducted item analysis post administering of assessment tasks to their learners and it was also established that none of the sampled teachers had developed proper intervention strategies pertaining to fractions teaching in grade 2.
- **Minutes of grade meetings addressing the teaching of fractions:** It was confirmed that all the participants did not have a platform to discuss the challenges encountered when teaching fractions in grade 2 since all the

schools sampled had only one class for grade 2 and therefore there was no evidence found of the implementation of resolutions taken during grade meetings because such meetings were not held at all the sampled schools.

- **Minutes of parent-teacher consultation meetings:** The researcher established from all the sampled participants that no parent-teacher consultation meetings were held.
- **Class visits and/or support programmes reports findings:** The researcher established that there were class visits schedules to conduct support programmes to the teachers on quarterly basis at all the sampled schools however, the implementation of those schedules was a bit slow sighting reasons of lack of time due to numerous disruptions as a result of teacher memorial services and workshops that are conducted during teacher-learner contact time.
- **Monthly written work output:** The researcher discovered that all the participating teachers were not able to comply with the expected number of written work output specified for a month due to contact time disruptions that were often encountered and also it was verified from one of the teachers that marking of learners' workbooks was not properly done because learners were credited even if their responses were not correct.
- **Evidence of catch-up programmes that were conducted in case of lost contact time:** The researcher confirmed that there was no evidence of catch-up programmes being administered to grade 2 learners in all the sampled schools.
- **Monitoring tools for quality assurance of assessment tasks:** The researcher established from all the sampled schools that all assessment tasks were moderated prior and post their administration to the learners. The only challenge identified was the fact that teachers did not cover all the cognitive levels when setting tasks.
- **Learner daily attendance registers:** It was established from all the sampled schools that learner daily attendance registers were properly marked on a daily

basis and the researcher further noted the high rate of learner absenteeism without valid reasons from parents.

- **Teacher movement registers:** The researcher established that most of the participants' trips that were authorised by the SMTs in all the sampled schools were for attending memorial services of other teachers and for attending workshops. The researcher further established that the teacher memorial services usually started at 12h00 and the commencement time for workshops normally vary, some starts at 9h00 while others starts at 12h00. This is an indication that, the trips that were taken by teachers disrupted the expected contact time of learners and teachers and the researcher further established from all participants that catch-up programmes were not administered with their learners to cover the time lost.
- **Teachers' leave register:** The researcher confirmed from all the sampled schools that the teachers' leave registers were available and updated on regular basis by the school principals. In addition, records of teachers' absenteeism were properly kept, where all teachers were required to sign for their leave of absence on submission of leave forms. Furthermore, the researcher established from the all the sampled participants that they were attending school on regular basis.

5.3.2. Classroom observation

The researcher managed to established the following factors during classroom observations that contributed in answering the postulated research question. Below are the findings that were established by the researcher during the classroom observation sessions.

- **School attendance and punctuality:** The researcher established from the two schools that were sampled that learners were not attending school regularly whereas in the case of teachers, all of them were attending school on regular basis.

- **Class-size:** The researcher established that the teacher-learner ratio in two of the schools that were sampled was a challenge because one school was posing a challenge of overcrowding in a single classroom whereas the other school had multi-grade class wherein grades R-3 were combined into a school hall. Only one school had a minimal number of learners in a class whereby the teacher-learner ratio was beneficial to promote effective teaching and learning.
- **Availability of teaching resources:** The researcher established from all the schools that concrete resources were utilised to teach fractions partitioning. The only challenge that was established was that the resources were not enough in all the schools and also that the available resources were not properly utilised to promote effective teaching and learning of fractions partitioning because some learners did not have chance to see how those resources were partitioned due to overcrowdedness in the classroom. Only those that are seated at the front could see what the teacher was doing.
- **Classroom management:** The researcher established from only one sampled school that the number of learners in a class were minimal and the teacher was capable of controlling learners' disruptive behaviour during the lesson presentation and there were no peripheral conversations and other interferences to disrupt the learning activity from the learners. However, from the remaining two schools the researcher established that the high number of learners that the teachers were faced with in the classrooms was a serious challenge which resulted into disruptive behaviours, peripheral conversations and other interferences that disrupted the learning activity. Furthermore, set of clear established classroom rules were noted from all the schools that were sampled.
- **Addressing barriers:** The researcher established from the two schools that teachers were struggling to address learner barriers due to the high number of learners in their classrooms. This hampered effective teaching and learning for fractions partitioning. Learning barriers that were identified by the researcher from both observations. The researcher was able to establish barriers such as some learners sleeping while the teacher is busy presenting the lesson and this may be caused by the fact that the learners were sick and the teachers couldn't realise that because of the large number of learners in a classroom, another

barrier that was identified at one of the sampled schools was that there were some learners who were busy teasing other learners while the teacher is presenting the lesson. Furthermore, the researcher established that one of the learners couldn't respond to the teacher's questions and the teacher disclosed that the same learner is always quite even if it is during breaks when other learners are playing. Generally, the researcher then disclosed that all the sampled teachers were not capable of addressing learning barriers that their learners are confronted with on daily basis.

- **Curriculum implementation:** Lesson plans for all the sampled participants were prepared in line with the workschedule. The researcher further identified that one of the teachers displayed challenges with preparation of lesson plans and tasks for fraction partitioning, however all the lesson plans were not quality assured by their departmental heads. Furthermore, the researcher revealed that all the sampled teachers employed concrete resources when administering lessons on partitioning of circular representations. However, the challenge that was spotted from all the schools that were sampled was that the teachers did not emphasise to the learners that when partitioning fractions they must ensure that the partitioned spaces must always be equal hence the learners were able to partition the whole according to the numbers that were given by the their teachers but not making sure that the partitioned spaces are equal.
- **Providing feedback:** The researcher established that learners' workbooks were controlled on regular basis, however it was revealed from one of the teachers that learners were sometimes credited for the incorrect responses that they gave.

5.3.3. Semi-structured interviews

The researcher managed to establish the following during semi-structured interviews that displayed to be contributing factors to the challenges that are encountered by grade 2 teachers when teaching fractions in Koloti circuit.

5.3.3.1. Demographic variables and challenges met when teaching fractions

The following discoveries were established by the researcher, namely:

- Learners are from child-headed families and, therefore, they do not receive the maximum support from their next of kin;
- Learners are unable to bring to school real objects from their home, objects that can be employed by the teachers when teaching fractions;
- There is a high rate of learner absenteeism without valid reasons;
- Parents do not attend consultative meetings when summoned by the school;
- High rate of burglary takes place in schools due to high rate of unemployment in the community, which results in learner books and other useful teaching resources being vandalised by criminals;
- A high rate of teacher time-offs to attend memorial services that take place during learner contact time;
- There is a lack of teacher pedagogical content knowledge in mathematics;
- Teachers' lack inclusive education background hence they are unable to address learning barriers that are displayed by some of the learners in their classrooms.
- Teachers' lack of knowledge on how to deal with a multi-grade classroom results in administration of one topic to the whole group, irrespective of the specified curriculum content and the grade.
- Lastly, classrooms are overcrowded.

5.3.3.2. Approaches and theories of learning employed when teaching fractions

The researcher established the following findings on the approaches employed when teaching fractions, namely: whole group teaching; question and answer method; role playing, grouping learners according to their various intellectual abilities and employment of real objects when teaching fractions. Furthermore, during this research project, the researcher deduced from the participants that the following theories of learning are employed during fractions teaching; namely: constructivism and ZPD.

5.3.3.4. Problematic aspects of fractions and professional growth programmes

The researcher detected that, in all schools that were sampled; learners displayed a challenge with regard to the partitioning of circular representations, ending up with the correct number of pieces that were uneven. On the other hand, teachers were not offered content related workshop by their curriculum advisors. It was further deduced that, the professional workshops that are organised, commenced at 12h00, while teachers were tired from their daily school routine. Teachers, therefore, end up being stacked with lots of information to grasp within a short space of time.

5.4. RECOMMENDATIONS TO THE RESEARCH STUDY

Since the aim of this research was to explore how fractions are taught in grade 2 at schools in the Koloti Circuit, in order to understand the challenges encountered by teachers when teaching fractions to these learners, the researcher then tabulated the following recommendations that gave response to the research findings in order to answer the postulated research question.

- Teachers should go an extra-mile and provide learners with enough concrete resources and further group their learners so that all learners are given a fair chance to see how partitioning of circular representations is done.
- Teachers should always make sure that they emphasise the issue of equal portions when teaching learners about partitioning circular representation amongst two or more people.
- The rainbow workbooks that are distributed to schools should be effectively utilised to improve learner performance in mathematics and fractions teaching in particular.
- Teachers should develop catch up programmes for lost contact time inform parents in writing when such programmes will be administered at school in order to assist learners.
- Principals should ensure that, when allocating subjects and grades to their teachers at school, competent and/or qualified teachers in mathematics are allocated to teach the subject.
- Principals and curriculum advisors should monitor syllabi-coverage adequately.

- The Department of Education should offer on-going training to teachers that are faced with multi-grade classrooms and extra posts should be allocated to such schools.
- The Department of Education should ensure that, small schools are merged and provide schools with more classrooms for our learners in order to avoid over-crowding in the classrooms.
- Curriculum advisors should organise more content workshops to assist teachers who experience challenges with the teaching of fractions. These workshops should be scheduled during school holidays in order to allocate sufficient time for them to take place and avoid disrupting teaching time.
- Teachers should notify parents when their children are absenting themselves from school on regular basis without valid reasons and ensure that parents know the negative impact on teaching and learning that is created by regular absenteeism of their children.
- Teachers should notify parents about the benefits of attending consultative meetings and also encourage them to attend such meetings.
- Teacher memorial services should be conducted after learner contact time.
- More after care centres with qualified tutors should be established in the area to assist learners from child-headed families with their school work.
- The Department of Education should provide state paid security services at their schools in order to eradicate high rate of burglary taking place in schools.
- People who are unemployed should be allowed to offer their services to community work programmes in order to diminish the high rate of unemployment which prevails in the community.

5.5. LIMITATIONS TO THE STUDY

The study was constrained to the primary schools offering foundation phase in Koloti Circuit, Capricorn District, Limpopo Province only. The focal point was centred on grade 2 classes and teachers, since the study was aimed at exploring the teaching of fractions in grade 2 in order to pick up the challenges encountered by teachers when teaching fractions to these learners.

Furthermore, the other limitation that the researcher observed from the participants was that, they could have felt that their territory is being threatened as they were not free when answering some of the interview questions that were posed to them.

The study further had limitations emanating from the participants who then decided to pulled-out of research process just before the second session of the interviews as they were scheduled for two days, and the researcher had to look for replacements within a short space of time which is quite time consuming.

The researcher as a school principal could have contributed to the limitations of this study because fieldworks were conducted in the afternoon because the researcher was also attending to normal obligations at workplace; and as a result time constraints were limitations that could have affected the comprehensiveness of the data collected. Also, financial resources were a major limitation because the researcher did not obtain any sponsorship to conduct the research project.

Lastly, findings of this study may not be resourceful countrywide since the researcher conducted the study involving teachers from only three schools in Koloti circuit.

5.6. CONCLUSION

In this chapter the introduction, research design and method including the summary of research findings, in which the well-defined interpretation which justified the outcomes of the research inquiry solely for creation of bonds between the testaments acquired from the participants and the prevailing knowledge were presented. Lastly, the recommendations resulting from the research study were presented, since the aim of this research was to explore how fractions are taught in grade 2 at schools in the Koloti Circuit, in order to understand the challenges encountered by teachers when teaching fractions to these learners.

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APPENDICES

Appendix A1: Participants' consent letter

Title: CHALLENGES ENCOUNTERED WHEN TEACHING FRACTIONS IN GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE

Dear participant,

This serves as a consent letter that you are voluntarily going to participate in this research. Participation from the research may be withdrawn at any time without any penalty being imposed on you. Furthermore, you allow the researcher to take photos, videos including audio tapes during your lesson presentation in order to assist the researcher to transcribe what transpired during the lesson. All the conversations and the answers given will be strictly confidential; however, other researchers or legal purposes may use information from the research if the need arises.

Findings from this research may be presented at meetings or published in papers and your name will never be published in any of the presentations or papers. Furthermore, only summary results of the research will be reported at the University of Limpopo for academic purposes only; and such results will never be reported at any school or classroom level.

If this consent letter contains language that is not clear to you, please do not hesitate to seek clarity from the researcher. In future, if you have any questions about your participation in this research, feel free to contact the researcher.

----- Participant name printed	----- Participant signature	----- Date
----- Researcher's name printed	----- Researcher's signature	----- Date

Appendix A2: Guardian’s consent letter

Title: CHALLENGES ENCOUNTERED WHEN TEACHING FRACTIONS IN GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE

Dear Sir/Madam,

This serves as a consent letter that by virtue of being the principal at this school, you are voluntarily going to serve as a guardian on behalf of the parents for the grade 2 learners at your school, whom the researcher will be observing their participation during the lesson presentation that will be offered to them by their teacher.

All the answers that will be given by the learners during the lesson presentation will not be divulged to any other person but will be used for the purposes of this research only, which is to determine the challenges that are encountered by their teachers when teaching fractions in grade 2. Learner participation from the research may be withdrawn at any time without any penalty being imposed on them.

As a guardian to these learners, you also allow the researcher to take photos of the learner written work, videos including audio tapes that will assist the researcher to transcribe what transpired during the lesson presentation.

Findings from this research may be presented at meetings or published in papers and learner names and together with the school name will never be published in any of the presentations or papers. Furthermore, only summary results of the research will be reported at the University of Limpopo for academic purposes only; and such results will never be reported at any school or classroom level.

If this consent letter contains any language that is not clear to you, please do not hesitate to seek clarity from the researcher. In future, if you have any questions about learner participation in this research, feel free to contact the researcher.

----- Guardian name printed	----- Guardian signature	----- Date
----- Researcher’s name printed	----- Researcher’s signature	----- Date

Appendix B1: Participants' consent form

Title: CHALLENGES ENCOUNTERED WHEN TEACHING FRACTIONS IN GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE

I,..... confirm that (please make a tick (√) in the appropriate box).

		YES	NO
1	I have read and understood the information about the research project, as bestowed in the consent letter dated the_____.		
	I have been given the opportunity to ask questions about the research project and my participation.		
3	I voluntarily agree to participate in the research project.		
4	I understand I can withdraw my participation at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.		
5	Procedures on confidentiality have been clearly explained to me (e.g. use of pennames, anonymity of data, etc) to me.		
6	Terms of consent for observations, interviews, including document analysis as forms of data collection have been explained to me.		
7	I allow the researcher to take photos, video clips and make audio recordings during this research project		
8	The use of the data in research, publications, sharing and archiving has been explained to me.		
9	I understand that other researchers will have access to this data only if they agree to preserve confidentiality of the data.		
10	I would like my name used and understand what I have said or written as part of this study will be used in reports, publications and other research outputs so that anything I have contributed to this research can be recognised.		
11	I, along with the researcher, agree to sign and date this consent		

	form		
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If you consent to participate in this research, please sign on the dotted lines below and return this letter to the researcher using the envelope provided.

Participant name printed Participant signature Date

Researcher's name printed Researcher's signature Date

Appendix B2: Guardian’s consent form

TITLE: CHALLENGES ENCOUNTERED WHEN TEACHING FRACTIONS IN GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE

I,..... confirm that (please make a tick (√) in the appropriate box).

		YES	NO
1	I have read and understood the information about the research project, as bestowed in the consent letter dated the_____.		
2	I have been given the opportunity to ask questions about the research project and learner participation.		
3	I voluntarily allow grade 2 learners to participate in the research project.		
4	I understand I can withdraw learners’ participation at any time without giving reasons and that they will not be penalised for withdrawing nor will they be questioned on why they have decided to withdraw.		
5	Procedures on confidentiality have been clearly explained to me (e.g. use of pennames, anonymity of data, etc).		
6	Terms of consent for observations, interviews, including document analysis as forms of data collection have been explained to me.		
7	I allow the researcher to take photos, video clips and make audio recordings of grade 2 learners during this research project		
8	The use of the data in research, publications, sharing and archiving has been explained to me.		
9	I understand that other researchers will have access to this data only if they agree to preserve confidentiality of the data.		
10	Names of the learners can be used in this research.		
11	I, along with the researcher, agree to sign and date this		

	consent form		
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If you consent your grade 2 learners to participate in this research, please sign on the dotted lines below and return this letter to the researcher using the envelope provided.

----- Guardian's name printed	----- Guardian's signature	----- Date
----- Researcher's name printed	----- Researcher's signature	----- Date

Appendix C: Classroom observation schedule

Name of participant:
Date of observation:
Duration of the lesson:
Topic: CHALLENGES ENCOUNTERED WHEN TEACHING FRACTIONS IN GRADE 2 AT KOLOTI CIRCUIT: CAPRICORN DISTRICT, LIMPOPO PROVINCE
Rating scale: 1: not available; 2: sometimes available; 3: always available (X the appropriate space).

School attendance and punctuality: The scale is intended to measure the level of school attendance including punctuality for both teachers and learners to the classroom.			
Rating	1	2	3
Both learners and teachers attend school regularly.			
Daily school attendance registers for both learners and teachers are properly marked and updated.			
Both learners and teachers are punctual to the classroom.			
In case of teacher absenteeism, there is evidence of catch-up programmes.			
Catch-up programmes are properly monitored by the departmental head.			
Class-size: The scale is intended to capture teacher-learner ratio in the classroom.			
Rating	1	2	3
The teacher-learner ratio is beneficial to promote effective teaching and learning.			
Availability of teaching resources: The scale intends to measure the availability of teaching resources in the classroom.			
Rating	1	2	3
The teacher has concrete resources to teach fraction partitioning			
The teacher is having enough resources to teach learners in the classroom.			

Available resources are properly utilised to promote effective teaching and learning.			
Classroom management: The scale intends to get information on the teachers' ability in managing the class in order to create a positive classroom situation.			
Rating	1	2	3
The teacher shows efforts in controlling disruptive behaviour of the learners during the lesson.			
The teacher allows peripheral conversations and other interferences to disrupt the learning activity.			
There is evidence of clear, established classroom rules.			
Addressing barriers: The scale is intended to capture the level of the teacher's ability to address learner barriers that hampers effective teaching and learning.			
Rating	1	2	3
There are barriers that hinder learner participation during lessons.			
The teacher is able to deal with learners with learning barriers.			
Curriculum implementation: The scale is intended to measure the degree of the teacher's practices in implementing CAPS curriculum in the classroom.			
Rating	1	2	3
The lesson plan is prepared in line with the work schedule			
The teacher is able to prepare for lessons and tasks for fraction partitioning in particular.			
The lesson plan is quality assured prior administration to the learners			
The teacher is having suitable teaching aids to present the lesson to the learners			
The teacher able to manage learner diversity during lesson presentation			
The teacher is able to relate learning activities with the learner's daily life experiences.			
Learners are engaged in positive interactions with one another during the lesson.			
The teacher uses authentic assessment to assess learner'			

achievement.			
Learner engagement: The scale intends to capture the teacher's ability to ensure that all learners in the class focus on and participate in the learning activity. Passive and active engagements will be noted.			
Rating	1	2	3
Learners are actively involved during the lesson.			
Learners appeared disengaged during the lesson.			
The teacher sustained learner disengagement through-out the lesson.			
Instructional strategies: The scale is intended to capture the level of the teacher's ability in implementing instructional strategies in the classroom.			
Rating	1	2	3
The teacher is able to assist learners with challenging questions.			
The teacher is able to craft good questions to gauge learners' comprehension.			
All assessment tasks are quality assured prior administration to the learners.			
Assessment tasks address various learner cognitive levels.			
The teacher provides capable learners with appropriate and challenging questions.			
The teacher has an assessment programme for which is also known to the parents.			
Providing feedback: The scale is intended to check the teacher's ability to provide learners with adequate feedback.			
Rating	1	2	3
The teacher marks learners' workbooks on regular basis.			
The teacher provides regular feedback to the learners.			
Availability of any other relevant documentation: The scale is intending to capture the availability of any other relevant documentation that could assist in improving learner performance.			
Rating	1	2	3
The teacher has records that show Grade 2 Mathematics-			

Subject Improvement Plan (SIP) with special reference to fraction partitioning.			
The teacher has evidence of item analysis reports on fraction partitioning in particular.			
The teacher has minutes for Grade meetings to address challenges on fractions partitioning in particular.			
There is there evidence that the School Management Team (SMT) conducts class visits to support the teachers while teaching how to partition fractions .			
There is evidence of parent consultation meetings.			
There is evidence of records of monthly written work-output.			
Written work output for fraction partitioning is sufficient for the month.			

Appendix D: Interview schedule for grade 2 teachers

English version	Sepedi version
1. How long have you been teaching in this Grade?	Naa o na le mengwaga e mekae o ruta kreiti ye?
2. What are your professional teaching qualifications and do you have any other additional qualification in Mathematics teaching as a subject besides the one you acquired in your initial qualifications? Elaborate on your answer.	Naa mangwalo a gago a borutiši ke afe le gona o na le mangwalo a tlaleletšo a Dipalo ao o ithutetšego wona ka ntle le ao a borutiši? Hlalosa ka botlalo.
3. Which demographic variables do you normally encounter as a teacher that hampers proper teaching and learning of fractions to your learners?	Naa ke dišitišwa di fe tšeo wena bjalo ka morutiši o hlakanago le tšona tikologong ya gago tša go palediša gore thuto ya dipalo- phatlo e phethagatšwe gabotse go baithuti ba gago?
4. Which approaches do you normally use when teaching fractions to the learners in your classroom? Elaborate on your answer.	Naa ke ditsela di fe tšeo o ka di šomišago go ruta dipalo- phatlo ka mo phaphošing ya gago? Hlalosa ka botlalo.
5. What guides you to use those approaches?	Ke eng seo se go hlalago gore o šomiše ditsela tšeo?
6. Are there any theories of learning that are drawn with the employment of the teaching approaches indicated above? Elaborate on your answer.	Naa go na le dithiori tša go ithuta tšeo di nyalelanago le tšhomišo ya di ditsela tšeo o di hlalositšego? Hlalosa ka botlalo.
7. What challenges do you experience when teaching fractions to Grade 2 learners?	Naa ke dihlotlo di fe tšeo o hlakanago le tšona ge o ruta dipalo- phatlo ka go kreiti ya 2?
8. Which aspects of fractions are most problematic to these learners?	Naa ke dikarolwana di fe tša dipalo- phatlo tšeo di palelago baithuti?
9. How do you implement those aspects of	Naa dikarolwana tša dipalo- phatlo tšeo

fractions that are most problematic to the learners?	dipalelego baithuti o di tšweletsa ka mokgwa ofe go bona?
10. What recommendations can you give in order to maximise learner performance in as far as Grade 2 fractions teaching is concerned?	Naa ke dikakanyo di fe tšeo o ka di fago gore phethagatšo ya mošomo wa bana ba kreiti 2 mabapi le go rutwa dipalo-phetlo e be sehlogweng sa godimo?
8. Have you ever attended any content workshops pertaining to the teaching of fractions to Grade 2 learners?	Naa o ile wa fiwa thutofatlhošo ka ga go ruta dipalo-phetlo go bana ba kreiti ya 2?
9. How often are such workshops conducted at your school and/or Circuit? Elaborate on your answer.	Naa dithutofatlhošo tšeo di dirwa makga a makae sekolong goba sediko-thutong sa geno? Hlalosa ka botlalo.
10. Are the workshops conducted fruitful or not? Elaborate on your answer.	Naa dithutofatlhošo tšeo di abilwego di bile le mohola go wena goba aowa? Hlalosa ka botlalo.
11. What recommendations can you give regarding the state of the workshops?	Naa ke dikakanyo di fe tšeo o ka di fago mabapi le boleng bja dithutofatlhošo tšeo? Hlalosa ka botlalo.

Appendix E: Turfloop Research Ethics Committee Clearance Certificate



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

**TURFLOOP RESEARCH ETHICS
COMMITTEE CLEARANCE CERTIFICATE**

MEETING: 27 November 2018

PROJECT NUMBER: TREC/303/2018: PG

PROJECT:

Title: Challenges encountered when teaching fractions in grade 2 at Koloti Circuit, Capricorn District, Limpopo Province.

Researcher: MN Masenya

Supervisor: Ms KM Themane

Co-Supervisor/s: Dr F Bhyat

School: Education

Degree: Masters in Curriculum Studies


PROF. TAB MASHEGO

CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

- i) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
- ii) The budget for the research will be considered separately from the protocol.
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

Appendix F: Application for authorisation to conduct research

Enq: Masenya MN

P.O.Box 108

Cell: XXXXXXXXXXX

MARIBANA

0778

29 April 2019

DISTRICT DIRECTOR

DEPARTMENT OF EDUCATION: CAPRICORN DISTRICT

LIMPOPO PROVINCE

Sir

APPLICATION FOR REQUESTING AUTHORISATION TO ADMINISTER RESEARCH AT SAMPLED PRIMARY SCHOOLS IN KOLOTI CIRCUIT

I am a registered Masters student at University of Limpopo and my student number is XXXXXXXXXX. I therefore, apply for authorisation to administer research at sampled primary schools in Koloti Circuit.

The research title is as follows: **Challenges encountered when teaching fractions in grade 2 at Koloti Circuit: Capricorn District, Limpopo Province**. The aim of this investigation is to explore how fractions are taught in grade 2 at Koloti Circuit, in order to understand the challenges that are encountered by grade 2 teachers when teaching fractions to learners.

Participation in this research is charitable and participants may retract from the research at any time. There shall be no hazards encompassed in this research and participants shall not be fiscally rewarded. Participant's statutory privileges shall be guaranteed at all times. The distinctiveness of participants as well as that of the sampled schools shall also be kept unspecified.

The data assemblage techniques shall comprise observation, semi-structured talks and authentication of the manuscript. The final product of the research shall be in the form of a dissertation. The amassed records shall be retained behind the scenes.

On completion of my studies, I am inclined to share my verdicts with Limpopo Department of Education in order to uplift both learner and teacher performance in Mathematics in the district as a whole.

Attached find the Turfloop Research Ethic Committee (TREC) Clearance Certificate which allows the researcher to proceed with data collection at various schools as sampled.

Hoping for your positive response.


.....
Researcher's Signature

.....
Date

.....
Supervisor's Signature

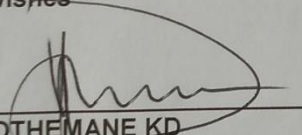
.....
Date

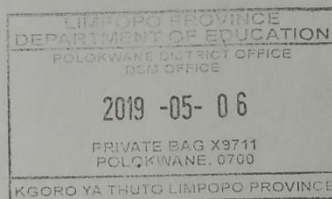
Appendix G: Approval from district office to collect data at schools

	LIMPOPO PROVINCIAL GOVERNMENT REPUBLIC OF SOUTH AFRICA	
DEPARTMENT OF EDUCATION		Private Bag X 9711 POLOKWANE 0700 Tel: 015 285 7410
CAPRICORN NORTH DISTRICT		
CONFIDENTIAL		
Ref: 2/2/2 Enq: Mogotlane HM Tel No.:015 285 7410 Date: 30 April 2019 Email: MogotlaneHM@edu.limpopo.gov.za		
To :	Masenya MN P O Box 108 MARIBANA 0778	
CC:	UNIVERSITY OF LIMPOPO Education faculty	
 <u>SUBJECT: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT PRIMARY SCHOOLS IN KOLOTI CIRCUIT – CAPRICORN NORTH DISTRICT.</u>		
 Title: “Challenges encountered when teaching fractions in grade 2 at Koloti Circuit: Capricorn North District: Limpopo Province”.		
 1. The above matter refers. 2. The Department wishes to inform you that your request to conduct a research has been approved. 3. The following conditions should be considered : 3.1 The research should not have any financial implication for Limpopo Department of Education. 3.2 Arrangements should be made with both the circuit offices and schools concerned.		
<hr/> 105 CNR Blaauwberg & Yster Street, Ladanna Capricorn North District, Private Bag X9711, Polokwane, 0700		
“ We Belong, We Care, We Serve ”		

- 3.3 The conduct of research should not in any way disrupt the academic programs in schools.
- 3.4 The research should not be conducted during the time of examinations especially the fourth term.
- 3.5 During the study, research ethics should be practiced, in particular the principle of voluntary participation (the people involved should be respected).
- 3.6 Upon completion of research study, the researcher shall share the final product of the research with the Department.
4. Furthermore you are expected to produce this letter at Circuit and Schools where you intend to conduct your research as evidence that you are permitted to conduct the research.
5. The Department appreciates the contribution that you wish to make and wish you success in your research.

Best wishes


 MR MOTHEMANE KD
 DISTRICT DIRECTOR



06/05/2019
 DATE

105 CNR Blaauwberg & Yster Street, Ladanna
 Capricorn North District, Private Bag X9711, Polokwane, 0700

"We Belong, We Care, We Serve"

Appendix H: Letter from language editor



The Computer Room

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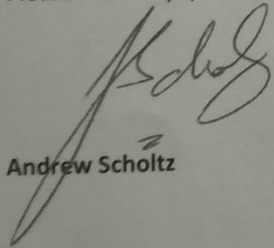
Date: 5 June 2019

To Whom it May Concern

I hereby confirm that I have proof-read the document entitled: "Challenges Encountered When Teaching Fractions in Grade 2 at Koloti Circuit: Capricorn District, Limpopo Province" authored by Masenya, Mmapula Nelly, and have suggested a number of changes which the author may, or may not, accept, at her discretion.

Each of us has our own unique voice as far as both spoken and written language is concerned. In my role as proof-reader I try not to let my own "written voice" overshadow the voice of the author(s), while at the same time attempting to ensure a readable document.

Please refer any queries to me.



Andrew Scholtz