



**The impact of teaching inference skills in Grade 10 Financial Mathematics during
a ten-week intervention programme**

By

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Education**

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DECLARATION

I, Sibusiso Thwala, hereby declare that this investigation into the impact of teaching inference skills in Grade 10 Financial Mathematics during a ten-week intervention programme (IP) is my own work and that it has not been submitted for any degree in any other university.

Signed:



.....

Sibusiso Thwala (213295296)

Date: 01 March 2024

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ABSTRACT

This study is rooted in the context of South Africa's educational landscape, where challenges related to reading comprehension and mathematical proficiency are prevalent. South Africa's participation in various educational assessments, such as the Western Cape Education Department Systemic Tests, the Trends in International Mathematics and Science Study and Progress in International Reading Literacy Study (PIRLS), consistently revealed poor results in mathematics and languages, indicating a struggle with reading for meaning, making inferences, and basic arithmetic. The national curriculum, as outlined in the Department of Basic Education's Curriculum and Assessment Policy Statement, underscores the importance of 'inference' as a sub-skill in comprehension and language awareness across all subjects. This study focuses on five Grade 10 learners, a crucial phase in South Africa's Further Education and Training band. Financial mathematics, a challenging subject within Mathematics, is integral to the curriculum, and learners often encounter difficulties with it. This research aimed to enhance five Grade 10 learners' knowledge of financial mathematics by teaching inference-comprehension skills within word problems. It also explored the improvement of learners' higher-order thinking skills and reading motivation in the context of financial mathematics.

A ten-week Intervention Programme (IP) was conducted. The first and last weeks were used to complete pre- and post-tests on Grade 10 learners' financial mathematics problem-solving abilities. The results of the pre-tests determined the content to be included in the eight-week teaching phase of the IP. During the IP, four comprehension strategies were taught to develop two of the PIRLS comprehension skills: focus on retrieving explicitly stated information, and making straightforward inferences. Learners demonstrated progress in understanding and calculating financial mathematics content, transitioning from the Bloom's taxonomy lower-order to higher-order thinking skills.

The following three research questions guided this study: What were the five learners' understandings of inference skills in a Grade 10 Financial Mathematics class before the IP? How did the five Grade 10 learners' cognitive abilities evolve during the IP? And what were the learners' understandings of inference skills after the ten-week IP? The conceptual framework of this study integrated three theories: Vygotsky's (1978) theory of social constructivism, the cognitive domain of Bloom's taxonomy (2001), and Wenger's (2005) social theory of learning, to provide a comprehensive understanding of the research questions. A qualitative approach was employed, utilising a case study design, within an interpretivist paradigm. Data gathered through semi-

structured interviews, participant observations, pre- and post-test results from the IP, and document analysis were inductively and deductively analysed.

Evidence from the study showed that the IP had a positive impact on the learners' understanding of inference skills, their ability to think more about their Mathematics problem sums more critically, and their performance in Grade 10 Financial Mathematics improved. The recommendations for teaching comprehension skills, especially inference skills, in Grade 10 Financial Mathematics include integrating effective comprehension strategies, emphasising contextual application in real-world scenarios, implementing regular assessments, fostering collaborative learning environments, and providing professional development for teachers. Additionally, recommendations for policy development suggest explicitly including inference comprehension skills in the official curriculum standards, allocating resources for relevant teaching materials, and integrating training into teacher education programmes. Further research is recommended to assess the impact of inference skill interventions on learners' performance and explore alternative teaching strategies for enhancing comprehension skills in financial mathematics.

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LIST OF ACRONYMS/ ABBREVIATIONS

| | |
|-------|---|
| CAPS | Curriculum and Assessment Policy Statement |
| CoP | Community of practice |
| CPUT | Cape Peninsula University of Technology |
| DoBE | Department of Basic Education |
| FET | Further Education and Training |
| GET | General Education and Training |
| HDC | Higher Degrees Committee |
| HEI | Higher education institutions |
| IP | Intervention programme |
| LoLT | Language of learning and teaching |
| MKO | More Knowledgeable Other |
| NDoBE | National Department of Basic Education |
| NQ | National quintile |
| PIRLS | Progress in International Reading Literacy Study |
| TIMSS | Trends in International Mathematics and Science Study |
| VAT | Value added tax |
| WCED | Western Cape Department of Education |
| ZPD | Zone of proximal development |

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1. Introduction

Chapter 1 provides an overview of the study, covering its background, rationale, context, approach, purpose and goals. It offers insight into the study's research title, main research question and sub-questions. It also clarifies important terminology, discusses the significance of the work, and presents limitations and assumptions of the study. Lastly, an explanation of the dissertation's organisation is provided

The genesis of this research can be traced back to 2017, when the researcher began his teaching career. However, it was in 2018, during the pursuit of an Honours degree in Inclusive Education, that a profound interest in working with learners experiencing learning barriers was ignited. This academic journey marked the first step towards a deeper understanding of the challenges faced by learners in diverse educational settings.

As the Head of Grade 10 at the school, the researcher formed part of the School Based Support Team (SBST). Among its duties, the team had the responsibility of identifying learners grappling with learning barriers and ensuring they received the necessary support. Simultaneously, the researcher was actively engaged as a mathematics teacher, contributing to the learners' education. In addition, he took on the role of facilitating mathematics intervention support programmes, seeking to bridge the educational gaps that learners faced.

During this time, the researcher's curiosity was piqued by the school's performance in the WCED Systemic Tests, sparking a deep interest in exploring the intricate interplay between literacy and numeracy. This curiosity culminated in his decision to embark on a journey towards a master's degree. This academic pursuit granted him a deeper understanding of inference-comprehension strategies and underscored fostering advanced cognitive abilities through intervention assistance programmes, especially in the realm of financial mathematics.

1.2. Background of the study

Background to this research encompasses several significant observations and insights that have shaped its foundation. The President of South Africa, Mr Ramaphosa (2019:14), stated that 'If we are to ensure that within the next decade, every 10-year-old will be able to read for meaning, we will need to mobilise the entire nation behind a massive reading campaign'. This recognition highlighted the prevalent challenge of learners struggling to read for meaning in South Africa.

The nation's involvement in various educational assessments, including the Systemic Tests for certain GET Grades (3, 6 and 9) by the Western Cape Education Department (WCED), and the Progress in International Reading Literacy Study (PIRLS) for Grade 4 learners, consistently yielded subpar results in mathematics and languages. These outcomes revealed a pronounced struggle among learners to grasp the nuances of reading for meaning, make straightforward inferences, and perform basic arithmetic.

The Department of Basic Education's (DoBE) Curriculum and Policy Statement (CAPS, 2011) for the Senior Phase (Grades 7-9) underscored the critical importance of 'inference' as a sub-skill in the development of comprehension and critical language awareness across all subject areas. This 'inference' skill was mandated to be incorporated into the curriculum throughout a child's schooling career. Howie, Combrinck, Roux, Tshele, Mokoena, and McLeod Palane (2017) contend that, as readers extract meaning from texts, they inevitably make inferences about ideas or information not explicitly presented.

This study's primary focus centres on Grade 10 learners, a pivotal grade in South Africa's Further Education and Training (FET) phase. Grade 10 serves as a foundational year, imparting many of the mathematical concepts required for success in Grades 11 and 12. Financial mathematics is an integral part of the mathematics curriculum and learners tend to struggle with this topic. Most of the skills taught in financial mathematics are applicable to other areas in the Mathematics curriculum, like statistics, trigonometry and probability. Financial mathematics is the application of mathematical methods to financial problems. It draws on tools from probability, statistics, stochastic processes and economic theory. Financial mathematics problems are scenario-based and include word problems.

Pournara (2013:18) asserts that 'Financial mathematics constitutes a well-developed area of the application of mathematics and has become an area of scholarly mathematical activity', emphasising that it extends beyond the treatment of exponential growth and geometric progressions found in the South African school curriculum. Lusardi and Mitchell (2011) further stress the importance of financial literacy, noting that individuals require financial skills to navigate today's volatile economic landscape. Financially literate individuals are better equipped to plan for retirement, engage in the stock market, and manage their debt efficiently. Financial literacy profoundly influences financial decisions, particularly in savings, borrowing, retirement planning, and portfolio selection.

The results of the Trends in International Mathematics and Science Study (TIMSS), conducted every four years, provide crucial insights. The 2011 and 2015 TIMSS results revealed poor performance among South African Grade 9 learners in mathematics, mirroring the 2019 WCED Systemic Tests for Mathematics. Spaul (2015) highlighted that in 2011, a significant portion of South African learners (32%) resorted to random guessing on the mathematics test, indicating a limited grasp of the subject. Furthermore, three-quarters (76%) of Grade 9 learners in 2011 demonstrated a lack of understanding of fundamental mathematical concepts. The TIMSS achievement results are reported on a scale from 0 to 1,000 points, with the 2015 results for South Africa, although still lagging behind many other participating countries, showing an improvement of 87 points, totalling 372 points in mathematics (Reddy, Visser, Winnaar, Arends, Juan, Prinsloo & Isdale, 2016).

Research has shown that learners' reading achievement and school success is primarily associated with reading motivation (Guthrie, Wigfield, Humenick, Perencevich, Taboada & Barbosa, 2006:232). Clinton (2015) reports on a positive relation between reading motivation and improvement in comprehension strategies, such as inference-making. He posits that learners who are motivated to read tend to engage naturally with a text which could lead to deeper understanding of the ideas within the text.

This thesis is primarily concerned with enhancing Grade 10 learners' knowledge of financial mathematics by teaching them inference-comprehension skills within financial mathematical word problem sums. Additionally, the dissertation explores the improvement of learners' higher-order thinking skills and reading motivation in the context of financial mathematics.

1.3. The Rationale of the study

Numerous studies have revealed a significant connection between mathematical word problem-solving proficiency and text comprehension skills, particularly within the context of financial mathematics for Grade 10 learners. The comprehension of word problems in mathematics often hinges on one's ability to understand and interpret the textual information presented. In this regard, English home language skills encompass essential aspects such as reading comprehension and the capacity to make inferences. The mastery of these skills not only facilitates the comprehension of written material but also plays a vital role in the successful resolution of mathematical word problems.

There is a noticeable research gap when it comes to the evaluation of Grade 9 learners' performance in financial mathematics as a distinct subject in conjunction with their home language

abilities. Provincial, national, and international assessments tend to treat these two components as separate entities. However, the WCED conducts annual Systemic Assessments of Grade 9 home language and mathematics, where financial mathematics constitutes a segment of the broader mathematics curriculum. Importantly, it predominantly comprises word problems, which are known to pose language challenges to learners.

The focus of this study is on Grade 10 learners at School X, a pseudonym for a school in the Western Cape region. According to the results of Provincial Systemic Assessments administered by the WCED to Grade 3, 6 and 9 learners, learners at School X face significant challenges in both mathematics and home language. The Grade 9 Systemic Assessment results, while not publicly disclosed by the WCED, are provided to individual schools for internal assessment.

Table 1: School X's WCED Systemic Assessment rates of their Grade 9 learners

| | 2018 | | 2019 | | 2021 | | 2022 | |
|----------------|-------|---------------|-------|---------------|-------|---------------|-------|---------------|
| | Maths | Home Language | Maths | Home Language | Maths | Home Language | Maths | Home Language |
| School X | 16.6 | 66.5 | 19.3 | 68.1 | 23.2 | 81.1 | 20.1 | 77.3 |
| Province | 23.0 | 52.6 | 22.7 | 53.6 | 21.6 | 50.1 | 18.8 | 50.2 |
| Quintile: NQ 5 | 46.8 | 78.6 | 44.4 | 79.1 | 46.9 | 75.6 | 40.8 | 74.2 |

Table 1 provides an analysis of School X's performance in the WCED Systemic Assessments for Grade 9 learners for the years 2018, 2019, 2021, and 2022, along with the provincial averages and the averages for schools in Quintile NQ 5. In 2020, the Systemic Assessments were not administered due to the repercussions of the COVID-19 pandemic.

In terms of mathematics performance, School X witnessed an increase from 16.6% in 2018 to 19.3% in 2019, indicating a positive shift. However, this upward trajectory was not sustained, as the score then improved to 23.2% in 2021 but declined slightly to 20.1% in 2022. While there is fluctuation, it is essential to note that School X's Mathematics performance consistently remains below the Quintile NQ 5 average for all four years and, notably, it remains lower than the provincial results in 2018 and 2019. This underscores School X's ongoing challenges in this subject compared to schools within Quintile NQ 5.

Conversely, in the context of home language performance, School X exhibited an impressive upward trend. The score increased from 66.5% in 2018 to 68.1% in 2019, further reaching 81.1% in 2021, and settling at 77.3% in 2022. School X's home language performance consistently outperforms the provincial for all four years, and also outperformed Quintile NQ 5 schools in 2021 and 2022, indicating a strength in this subject area.

Murray (2012:55) noted that many educators have expressed concerns about learners finding word problems in mathematics more challenging than straightforward computations. Indeed, word problems tend to be a source of aversion and apprehension for many learners. Given that financial mathematics predominantly employs a contextual approach, it predominantly features word problems. This study seeks to address this disparity and its implications, aiming to investigate the impact of teaching inference skills on the comprehension of word problem sums in Grade 10 Financial Mathematics, specifically among School X's Grade 10 learners in the Western Cape.

1.4. Context of the study

The researcher selected the high school where he had been employed as a teacher for the last three years as the data collection site. Situated in the Metro Central Education District (MCED), this institution is classified under quintile 5 (White & Van Dyk, 2019), primarily due to its geographical location in a high socio-economic area. According to the criteria set by the WCED, this classification implies that the school is situated in an affluent area with the ability to sustain itself through its school fee policies. However, it is essential to highlight that despite its location in a financially prosperous area, the majority of learners attending School X originate from economically disadvantaged surrounding areas.

For the purposes of this study, a specific group of five learners was purposively selected. These learners had consistently performed poorly in financial mathematics and ranked among the bottom five performers in this subject, however having the potential for improvement. The choice of five learners allowed the researcher to provide adequate individual and group attention and support. It is worth noting that the current student population at School X stands at 1063, with a student-to-teacher ratio of 35:1. English serves as the language of teaching and learning (LoLT). The researcher's selection of the institution as the research site was guided by his teaching responsibilities, rendering it a convenient location for data collection.

1.5. The approach to the study

In this qualitative case study, three data collection instruments were employed. Prior to commencing data collection, the researcher reached out to parents and guardians of the carefully

chosen participating pupils through telephone conversations. This initial contact aimed to secure permission for conducting interviews and consent to work with their children. During these telephone discussions, the researcher provided a comprehensive explanation regarding the selection of their children, the significance of the study and the planned utilisation of the gathered information. The researcher assured the parents and guardians that the learner's identities would be kept confidential; moreover, participants had the option to exit the study at any point without facing any negative repercussions. Additionally, the IP was outlined by the researcher, clarifying that it would span ten weeks, with sessions held twice a week, each lasting one hour. Permission was obtained from the school principal, the Western Cape Education Department, and the higher education institution (HEI) where the researcher was enrolled.

Additionally, interviews were conducted with two previous mathematics teachers who had been selected. Teachers were briefed on data collection procedures at the beginning of interviews, which occurred during school break times and were recorded for documentation.

Throughout the IP, the researcher observed the selected learners in class, focusing on their comprehension of financial mathematics word problems and their development, both cognitively and socially. The researcher actively participated in the activities alongside the learners, adopting the role of a participant observer. It is important to note that these notes were written on observation schedules just after each class, rather than being videotaped.

To assess the learners' progress, pre- and post-assessments were administered at the outset and conclusion of the IP, using the first and last weeks for this purpose. In between these assessments, the teaching phase of the intervention was implemented, where the teaching of inference-comprehension skills using the four comprehension strategies was done. Both assessments were carried out and concluded by the learners independently.

1.6. The purpose and goals of the study

The purpose of this research was to investigate the impact of teaching inference skills in Grade 10 Financial Mathematics over a ten-week IP, with pre- and post-tests administered in the first and last weeks. The objective was to evaluate each learner's grasp of inference skills in a Grade 10 Financial Mathematics class before, during, and after the IP.

The study's objectives were to introduce learners to comprehension strategies designed to enhance the understanding of inference-comprehension skills for five Grade 10 learners participating in the eight-week teaching phase of the IP. The researcher's goal was to aid these five Grade 10 learners in their cognitive development, particularly because they had previously

struggled academically. The study aimed to motivate these five learners to read with a focus on comprehension, encouraging them to think critically and ultimately enhancing their higher-order thinking abilities

1.7. The research title

The impact of teaching inference skills in Grade 10 Financial Mathematics during a ten-week intervention programme (IP).

1.8. The main research question and sub-questions

What is the impact of teaching inference skills in Grade 10 Financial Mathematics during a ten-week intervention programme (IP)?

Sub-questions

1. What were the five learners' understandings of inference skills in a Grade 10 Financial Mathematics class **before** the IP?
2. How did the five Grade 10 learners' cognitive abilities evolve **during** the IP?
3. What were the learners' understandings of inference skills **after** the ten-week IP?

1.9. Clarification of items

1.9.1. Pre- and post-tests

Lanning and Mallek (2017) posit that pre- and post-tests are assessments conducted before and after an intervention or educational programme. The pre-test is administered before the programme to establish a baseline, while the same post-test is given after the programme to measure the impact of the intervention on the participants' knowledge or skills.

The researcher conducted a pre-test on Grade 10 learners' financial mathematics problem-solving abilities, focusing on two comprehension skills. The results provided insights into the learners' strengths and areas that needed improvement. The findings shaped the content and direction of the teaching phase of the IP, which involved various comprehension strategies and financial mathematics content. This approach helped the learners acquire necessary inference-comprehension and financial mathematical proficiencies.

Similar to the pre-tests administered before the initiation of the IP, at the conclusion of the eight-week teaching phase of the IP, the researcher carried out an equivalent post-test. These assessments focused on evaluating the learners' ability to solve word problems related to financial mathematics, with an emphasis on the first two comprehension skills specified in the PIRLS document (Mullis, Martin & Sainsbury, 2016).

1.9.2. Intervention Programme (IP)

According to Pečjak and Pirc (2018), an intervention programme is a structured educational initiative strategically designed to address specific issues or challenges. In the context of this research, the IP spanned a duration of 10 weeks. The initial and final weeks were specifically reserved to conducting pre- and post-assessments. The remaining middle weeks constituted the teaching phase of the IP, with the primary aim of equipping the five Grade 10 learners with enhanced reading comprehension skills, enabling them to better understand and solve financial mathematics problems.

The content of the IP was drawn from the Grade 10 Mathematics curriculum outlined in the CAPS (2011) document. Each of these weeks was dedicated to a distinct topic within the Grade 10 Financial Mathematics section of the curriculum. Importantly, the researcher meticulously crafted the IP to encompass four comprehension strategies and higher-order thinking skills. Many learners face difficulties when dealing with word problems in financial mathematics, an integral part of the subject because of its practical uses. These challenges are often linked to issues in reading comprehension and inference-making, which are essential for problem-solving. To solve word problems, learners need to not only understand the language used but also interpret the specific information presented in the problem and perform the required calculations (Murray, 2012).

1.9.3. Comprehension strategies

Comprehension strategies are literacy exercises carefully crafted to aid pupils in grasping the nuances of a given text. The intention behind teaching these strategies was to empower the five Grade 10 learners with the essential reading comprehension skills such as inference making needed to enhance their ability to understand and solve financial mathematics problems. The researcher employed a set of specific comprehension strategies, including My turn-your turn, Think aloud, Anticipation guide, and Feature matrix.

1.9.4. The Progress in International Reading Literacy Study

The Progress in International Reading Literacy Study (PIRLS) is a comprehensive global test of learners' reading proficiency and it is conducted on a five-year cycle. PIRLS evaluates learners based on four essential comprehension processes: 'focus on and retrieve explicitly stated information', 'make straightforward inferences', 'interpret and integrate ideas and information', and 'evaluate content and textual elements' (PIRLS, 2016).

South Africa has been an active participant of the PIRLS study every five years, with involvement in 2001, 2006, 2011, 2016 and 2021. The results of the PIRLS study in 2021 were concerning,

with the country ranking last out of the 57 countries that participated in the study. The average reading score for South African learners was significantly lower compared to the international average, and the results further showed that 82% of Grade 4 learners were unable to read for meaning (Ndhlovana & Charamba, 2023).

1.9.5. Financial mathematics

Financial mathematics is a content area in the curricula for Mathematics and Mathematical Literacy in South Africa. Financial mathematics is a field of mathematics that deals with applying mathematical principles to solve financial problems. It draws on concepts from probability, statistics, economic theory, and other mathematical tools to address financial challenges, often involving scenarios and word problems (Pournara, 2011).

1.9.6. Bloom's taxonomy

Bloom's taxonomy is a framework for classifying educational objectives and cognitive skills. It was developed by Benjamin Bloom in 1956 and later revised in 2001 by Anderson and Krathwohl. This framework categorises learning objectives into different levels of cognitive complexity, starting from lower-order thinking skills, such as remembering and understanding, to higher-order thinking skills, including analysing, evaluating, and creating (Anderson et al. 2001). Bloom's taxonomy serves as a valuable tool for educators to design and assess learning activities, ensuring that learners engage in a range of cognitive tasks to promote deeper understanding and critical thinking (Krathwohl, 2002). The researcher incorporated this theoretical framework into his teaching approach as the CAPS Grade 10 Mathematics document explains and supports the use of Bloom's taxonomy as a teaching tool.

1.10. Significance of the study

The significance of this study extends to both the WCED as well as the Department of Basic Education (DoBE). South Africa's education system faces the ongoing challenge of improving reading comprehension and mathematical proficiency, as underscored by its performance in international assessments like PIRLS and TIMSS. This study's potential to enhance Grade 10 learners' comprehension skills and mathematical problem-solving abilities directly aligns with the goals of both WCED and DoBE.

Additionally, this study offers a valuable contribution to mathematics teachers in both the GET and FET phase. It highlights the importance of equipping teachers with the knowledge and skills required to integrate comprehension strategies within the context of financial mathematics. The interplay between literacy and numeracy, as emphasised in this research, underscores the need

for teachers to adopt effective teaching methods that bridge the gap between language skills and mathematical problem-solving.

By addressing these critical aspects, this study not only benefits learners but also serves as a valuable resource for teacher training programmes, equipping future teachers with the tools to enhance the quality of education and learners' performance in South Africa. It fosters a supportive learning environment and promotes higher-order thinking skills, which are essential for academic success and practical decision-making. In doing so, it aligns with the educational objectives of both WCED and DoBE (CAPS, 2019) while contributing to the broader mission of improving education in South Africa.

1.11. Limitations of the study

It is important to acknowledge several limitations in this research which was a qualitative study only. The study was conducted exclusively in one quintile 5 school within the Metro Central Education District (MCED) in Cape Town. The researcher's role as an educator in this institution limited the ability to extend the research to other schools. The study focused on a specific group of five Grade 10 learners. While this smaller sample size was intentional to allow for in-depth data analysis, a larger and more diverse sample could have provided a more comprehensive perspective. Additionally, the researcher chose to work with a smaller class to ensure a manageable workload for data analysis. Finally, the study took place in the aftermath of the COVID-19 pandemic, which may have introduced additional factors influencing the learning environment.

1.12. Assumptions of the study

The five learners and two former teachers who participated in the research were anticipated and expected to willingly engage in the research and provide honest responses. The study further assumed that the data collected, including pre- and post-test results, interviews, and observations, accurately reflect the participants' abilities, experiences, and cognitive development.

1.13. Organisation of the dissertation

CHAPTER 1

In Chapter 1, the study commences by introducing the research, encompassing the background, rationale, context, approach, purpose, and goals. This section offers an understanding of the research's title, the main research question, and sub-questions. Additionally, it outlines the explanation of terminologies, explores the importance of the work, and presents the research's underlying limitations and assumptions. Ultimately, this chapter elucidates how the dissertation is organised.

CHAPTER 2

This chapter introduces the conceptual framework that served as the foundation for this study. Subsequently, the chapter proceeds to delve into a literature review in which it discusses the following concepts: inference making, financial mathematics, reading motivation, the classroom environment, and the four comprehension strategies employed in the IP. Finally, the chapter concludes with a summary.

CHAPTER 3

In this chapter, the study delves into the research paradigm, approach, and design utilised to examine the impact of teaching inference skills on the comprehension of word problems in Grade 10 Financial Mathematics. The chapter offers an overview of the methods and procedures employed in the research, encompassing aspects such as site selection, participant selection, data collection instruments, data analysis, trustworthiness, the researcher's role, and, lastly, ethical considerations.

CHAPTER 4

Chapter 4 of the study provides an in-depth examination and discussion of the analysed data related to the main research question and three sub-questions. It discusses the results of understanding inference skills among five Grade 10 Financial Mathematics learners before, during and after the IP.

CHAPTER 5

In this chapter, conclusions are drawn based on the research findings, and suggestions for practice, policy, and future research are provided.

CHAPTER 2

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1. Introduction

This chapter introduces the conceptual framework that shaped this research. Following this, a literature review delves into key concepts, including inference making, financial mathematics, reading motivation, the classroom environment, and the four comprehension strategies employed in the IP. The chapter ends with a summary.

2.2. Conceptual framework

This research study is built upon a conceptual framework that combines three fundamental theoretical viewpoints to guide its exploration into the impact of teaching inference skills in Grade 10 Financial Mathematics throughout the ten-week Intervention Programme (IP). These theories encompass Vygotsky's (1978) theory of social constructivism, Bloom's taxonomy (2001) of the cognitive domain, and Wenger's (2005) social theory of learning. Each of these theoretical concepts is discussed individually to elucidate their specific roles within the study and their collective contribution to the comprehensive understanding of the research questions. The researcher selected these theories because he engaged with the group of learners throughout the IP, aiming to foster their cognitive abilities and inferential thinking as they applied four comprehension strategies.

Table: 2.1 The three theories referred to in this thesis

| Main theorist | Theory |
|-------------------------------|--|
| 2.1.1 Vygotsky (1978) | 2.2.1 Theory of social constructivism <ul style="list-style-type: none"> • More Knowledgeable Other (MKO) • Scaffolding • Zone of proximal development (ZPD) • Cognitive development |
| 2.1.2 Bloom's taxonomy (2001) | 2.2.2 Theory of cognitive domain <ul style="list-style-type: none"> • Remembering • Understanding • Applying • Analyzing • Evaluating • Creating |
| 2.1.3 Wenger's (2005) | 2.2.3 Social theory of learning <ul style="list-style-type: none"> • Community of practice |

2.2.1. Vygotsky's theory of social constructivism

Vygotsky's theory of social constructivism (Vygotsky, 1978) played a foundational role in this research study by providing a theoretical framework for understanding how learners develop cognitive skills through social interactions. This theory was particularly relevant to this investigation, as the primary focus was on teaching and observing learners' progress during the eight-week teaching phase of the IP in the context of Grade 10 Financial Mathematics (Vygotsky, 1978; Van der Veer, 2014).

In this study, Vygotsky's (1978) theory was applied to guide the design and implementation of the IP. The More Knowledgeable Other (MKO) concept, as explained by Vygotsky, emphasises the importance of an expert or teacher in facilitating a learner's development. Throughout the IP, the researcher closely interacted with the Grade 10 learners, creating opportunities for them to learn from both the researcher and their peers. This active engagement allowed for the application of scaffolding, where assistance given by the researcher was gradually withdrawn as the learners internalised new knowledge and skills (Vygotsky, 1978; Wittmer, Petersen & Puckett, 2013). This process of scaffolding involved the use of leading questions and guidance to help learners answer complex questions and solve problems. This approach was pivotal in ensuring that all learners were actively engaged and made progress during the IP (Vygotsky, 1978; Wittmer et al. 2013).

The zone of proximal development (ZPD), a central concept within Vygotsky's theory, was utilised to mediate the learners' learning experiences. The ZPD refers to the difference between a learner's actual level of development and the level of performance achievable with the support of an adult or more capable peer (Vygotsky, 1978; Louw, Van Ede & Louw, 1998). During the IP, the researcher worked within the learners' ZPD, ensuring that they were challenged but not overwhelmed. This mediation was crucial in promoting 'new learning' among the learners, fostering their cognitive development in the context of financial mathematics (Vygotsky, 1978; Louw, Van Ede & Louw, 1998).

The utilisation of scaffolding within the ZPD was suitable for this research due to its capacity to offer essential support and guidance in task execution and completion. Throughout the IP, the researcher played a pivotal role in offering assistance and guidance to the five learners, facilitating a more profound grasp of the four comprehension strategies and two comprehension skills they were actively involved in. The mentorship and support contributed significantly to the learners' observable cognitive advancement and improved comprehension skills, as demonstrated in the post-assessment results detailed in Chapter 4.

2.2.2. Bloom's taxonomy

Bloom's taxonomy, a frequently cited framework that was originally proposed by Benjamin Bloom and further expanded upon by Anderson and Krathwol (2001), is a widely recognised framework for categorising cognitive processes and thinking skills. It classifies educational objectives into six distinct categories, each representing varying levels of cognitive complexity. These levels range from lower-order cognitive skills, such as remembering, understanding, and applying, to higher-order cognitive skills like analysing, evaluating, and creating.

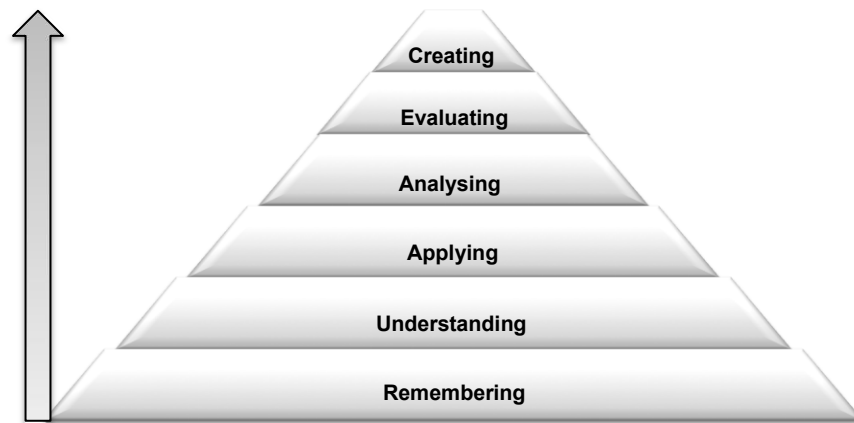


Figure 2.1 Bloom's taxonomy (2001)

The taxonomy provides a framework for teachers to design and evaluate learning objectives, assessments, and instructional strategies to promote learners' cognitive development. The researcher adopted this theory since it is widely accepted in the sphere of education, and used it to scrutinise the cognitive progression of the group of Grade 10 pupils throughout the eight-week teaching phase of the IP.

The 2011 CAPS (Curriculum and Assessment Policy Statement) is the curriculum framework that is used in South Africa to guide teaching and learning in schools and is complemented by Bloom's taxonomy. Notably, CAPS for Grade 10 Mathematics includes a focus on financial mathematics, which covers overarching topics such as growth and decay. One of the NDoBE (2011: 26) CAPS objectives states that learners have to 'understand and use the concept of simple and compound interest'. Using Bloom's taxonomy and comprehension strategies, the researcher designed lessons for the IP that required learners to not only remember and understand the concepts of simple and compound interest but also apply those concepts to solve word problem sums, analyse the differences between simple and compound interest, evaluate the effectiveness of different interest rate calculations, and give their own examples when explaining.

Considering that this research study aimed to enhance learners' comprehension and cognitive skills, the study incorporated both Bloom's revised taxonomy (Anderson & Krathwohl, 2001) and the PIRLS comprehension cognitive levels into the eight-week teaching phase of the IP. The integration aimed to align the IP with the research objectives. Although all PIRLS levels were part of the IP, the pre- and post-tests primarily focused on retrieving explicitly stated information and making straightforward inferences. This emphasis on making straightforward inferences aligned with the main research question, which sought to evaluate the impact of teaching inference skills in Grade 10 Financial Mathematics during the IP.

In this study, Bloom's taxonomy served as a valuable tool to assess the cognitive development of Grade 10 Financial Mathematics learners participating in the IP. The taxonomy aided in categorising and evaluating the learners' cognitive growth by analysing their performance at different levels of thinking. Through the use of verbatim quotations and cognitive verbs associated with each level, the study tracked the learners' progression from lower-order thinking, which involves recalling facts and understanding concepts, to higher-order thinking, such as analysing and evaluating complex financial mathematics problems. This framework offered a structured approach to scrutinising the learners' cognitive development throughout the study, assisting in the examination of their progress, comprehension skills, and higher-order thinking abilities during the intervention.

2.2.3. Wenger's social theory of learning

Wenger's (2005) social theory of learning was another crucial theoretical framework employed in this research study. It emphasised the role of social participation in the learning process and provided insights into how knowledge and practice are intertwined within a community of practice (CoP) (Wenger, 2005; Wenger, McDermott & Snyder, 2002).

The study leveraged Wenger's concept of a CoP by considering the classroom as a community of practice where the learners actively participated in financial mathematics and comprehension activities. This social learning process allowed them to share their perspectives and understanding of various topics with their peers (Wenger, 2005). Through interactions, a community of practice was formed, creating an environment where learners could collectively enhance their knowledge and skills.

One key feature of this CoP that was highlighted in this study was its social nature. According to Wenger, McDermott, and Snyder (2002), learning is not solely an individual process but is significantly influenced by social interactions. The CoP facilitated collaborative learning, enabling

learners to share knowledge, skills, experiences, and ideas with one another. This social learning process enhanced their understanding of financial mathematics, further contributing to their cognitive development (Wenger, McDermott & Snyder, 2002).

The conceptual framework of this study integrates Vygotsky's theory of social constructivism, Bloom's taxonomy, and Wenger's social theory of learning to provide a comprehensive understanding of the research questions. These theories collectively inform the study's exploration of how social interaction, collaborative learning, and cognitive development occur within the context of teaching inference skills in Grade 10 Financial Mathematics during the ten-week intervention programme. This framework guided the study in examining the learners' progress, comprehension skills, and higher-order thinking abilities as they engaged in the intervention.

2.3. Literature review

2.3.1. Introduction

This section begins by delving into the significance of inference making, a crucial reading comprehension skill, and its relevance to our study of Grade 10 Financial Mathematics. Additionally, it discusses the importance of financial mathematics within the school curriculum, the role of reading motivation in comprehension, the impact of the classroom environment on learning, and the four comprehension strategies implemented in the IP.

Table 2.2 Outline of concepts discussed and the comprehension strategies utilised in the study

| Themes | Sub-themes |
|--|--|
| 2.3.2 Inference making | |
| 2.3.3 Financial mathematics | |
| 2.3.4 Reading motivation | Intrinsic motivation Extrinsic motivation |
| 2.3.5 The Classroom environment | Creating a supportive learning Physical layout and design Teacher-student relationship Collaborative learning Effective classroom management |
| 2.3.6 Four comprehension strategies utilised during the IP | 2.3.6.1 My turn-your turn 2.3.6.2 Think aloud 2.3.6.3 Anticipation guides 2.3.6.4 Feature matrix |

2.3.2. Inference making

Mirafuentes, Lopez, and Diano (2015) delineate four distinct levels of reading comprehension skills essential for a comprehensive understanding of textual content: the literal, inferential (reading between the lines), critical, and evaluative levels. The literal level entails the comprehension of ideas that are overtly, directly, and explicitly conveyed within the text. Of particular relevance to this study was the inferential reading comprehension skill, which revolves around a learner's ability to make predictions based on contextual cues and background knowledge, much like the critical and evaluative reading comprehension skills.

According to O'Brien, Cook, and Lorch (2015), inference making encompasses the process of integrating information both within the text and between the text and the reader's general knowledge of the subject matter. Howie et al. (2017) emphasise that making inferences empowers readers to delve beneath the surface of the text, bridging the gaps in meaning that often arise in written content. It is noteworthy that some of these inferences are straightforward, as they rely primarily on information explicitly contained within the text. In such instances, readers may need to connect disparate ideas or pieces of information, forming an integral part of inferential reading comprehension.

Graesser, Li, and Feng (2015) draw attention to two general categories of inferences consistently formulated during the reading process. They classify one type as 'text-based inferences', which involve linking current information in the text with information previously encountered in the text. The second type is 'knowledge-based inferences', which require the integration of current textual information with the reader's pre-existing knowledge on the subject. Both text-based and knowledge-based inferences serve the purpose of helping the reader to bridge information gaps within the text, fostering a more complete understanding.

Oakhill, Cain, and Elbro (2014) make a critical distinction between two types of inferences central to text comprehension: 'local cohesion inferences' and 'global coherence inferences'. 'Local cohesion inferences' entail the reader's effort to elucidate the meanings of words and phrases by establishing connections with other terms within the text. On the other hand, 'global coherence inferences' facilitate the holistic understanding of the text, connecting different parts of the text by weaving them into a mental model of the content. The acquisition of skills in making both 'local cohesion' and 'global coherence' inferences holds the potential to enhance reading comprehension.

Barth and Elleman (2017:32) assert that 'inference making is the most potent predictor of comprehension among adolescent readers, with less skilled adolescent readers demonstrating

lower accuracy and slower formation of text- and knowledge-based inferences compared to their skilled counterparts'. They contend that explicit instruction in inference making can result in significant improvements in reading comprehension, particularly among struggling readers in the middle grades. This proposition gains support from a recent synthesis (Hall, 2016) and a meta-analysis (Barth et al. 2015) examining the effects of teaching inference making on reading comprehension among elementary and secondary grade learners.

In this specific research project, the researcher embraced the comprehensive spectrum of inference-making skills as defined above and aimed to guide learners in recognising and applying various inference skills when confronted with word problem sums.

2.3.3. Financial Mathematics

Financial mathematics plays a crucial role in the school curriculum, holding a significant weightage of 35% in the Mathematical Literacy examination and 15% in Mathematics for Grade 10 learners, according to the CAPS (2011) curriculum. Classified as an application topic, financial mathematics, as defined by the CAPS (2011:13) document, presents scenarios relevant to everyday life, the workplace, business environments, and broader societal, national, and global issues. This topic encompasses a wide array of concepts, such as finance, financial documents, growth, tariff systems, income, expenditure, profit/loss, budgeting, interest, banking, loans, and investments.

The CAPS (2011) curriculum outlines the progression of financial mathematics across different educational phases. Within the Foundation Phase, encompassing Grade R to Grade 3, learners engage with basic financial concepts, while in the Intermediate Phase (Grade 4–6), the focus shifts to buying and selling, profit and loss, and basic budgeting. The Senior Phase (Grade 7–9) introduces learners to more explicit financial topics, such as accounts, loans, simple interest, hire purchase, and exchange rates. By Grade 9, the notion of compound interest is introduced.

Grade 10 represents a crucial stage in the progression of financial mathematics. The curriculum extends learners' knowledge, emphasising the importance of working with growth formulae, as opposed to iterative calculations. Pournara (2007) underscores the significance of this transition, highlighting the introduction of different compounding periods and the distinction between nominal and effective interest rates in Grade 11. In Grade 12, the curriculum delves into annuities, critical analysis of investment and loan options, and the application of logarithms in compound growth and decay problems.

In the context of financial mathematics, learners are encouraged to connect their understanding of the topic to real-life scenarios, in accordance with the Further Education and Training CAPS Amendments (2019:27). The document encourages educators to design assessment tasks aligned with the cognitive levels of Bloom's taxonomy (Morton & Colbert-Getz, 2017). This alignment is particularly relevant for inference skills, which overlap with Bloom's levels of understanding (comprehending the meaning of facts) and applying (utilising facts, rules, concepts, and ideas).

However, many learners encounter challenges when confronted with word problem sums in financial mathematics, which are a core component of the subject due to its real-world applications. According to Murray (2012), these challenges are often attributed to learners' difficulties in reading comprehension and making inferences, as these skills are crucial for understanding the requirements of problem-solving. Solving word problems demands that learners not only comprehend the language used but also interpret the concrete information presented in the problem, create a mental model of the problem based on the provided information, formulate a solution plan, and execute the necessary calculations (Desoete, Roeyers & De Clercq, 2003).

This research project primarily focused on financial mathematics word problem sums that involved key concepts, including simple interest, exchange rates, taxation (VAT), compound interest, discount, timelines, salary increases, and profit and loss. These concepts are outlined in the FET Mathematics CAPS Amendments (2019). The study aimed to enhance learners' comprehension and problem-solving skills in this context.

Pournara (2011) emphasises the potential of financial mathematics within the school curriculum. He underscores the practical applications of simple and compound interest formulae ($A = P(1+i \cdot n)$ and $A = P(1+i)^n$). These formulae enable individuals to make sense of how the value of money changes over time. The concept of interest is introduced as early as Grade 7 in the South African mathematics curriculum (DoE, 2002). While most secondary school textbooks introduce learners to simple interest first, followed by compound interest with annual compounding, very few delve into the complexities of daily interest calculations and monthly compounding. These nuanced aspects are essential for learners to gain a more realistic understanding of financial mathematics (Pournara, 2011).

2.3.4. Reading motivation

Schaffner and Schiefele (2013) propose a positive correlation between reading motivation and inference generation, highlighting that the level of reading motivation may vary based on the reader's current state of motivation. In the context of reading, motivation can be broadly categorised into two types: intrinsic and extrinsic motivation. Intrinsic motivation pertains to a learner's innate willingness to engage in reading independently, motivated by personal enjoyment, individual goals, and the intrinsic value that reading provides. In contrast, extrinsic motivation is driven by external factors such as expectations and rewards (Wigfield, Guthrie, Tonks & Perencevich, 2004).

Wigfield et al. (2004) assert that individuals who are intrinsically motivated engage in activities for the inherent value of the activity itself, out of a genuine interest, and are driven by their internal desires rather than external incentives. They argue that it is essential to consider whether a decline in motivation is an inevitable process or if it can be enhanced by altering the educational experiences provided to children.

Extrinsic motivation for reading, as defined by Unrau and Schlackman (2006: 2), is the desire to participate in an activity due to a reward system or external social demands. This perspective diverges from behaviourist theories that encourage educators to employ rewards as a teaching strategy. Williams, Hedrik, and Tuschinski (2008: 135, cited in Jensen 1998) contest this behaviourist viewpoint by highlighting that both rats and humans exhibit an inherent inclination to explore new experiences and behaviours, even in the absence of tangible rewards or external pressures. They further propose that extrinsic rewards can potentially have adverse effects: diminishing intrinsic motivation, devaluing the love for learning, conveying misleading messages, and fostering a counterproductive competitive atmosphere.

This research focussed on exploring Grade 10 learners' intrinsic motivation to read financial mathematics word problem sums. Understanding how intrinsic motivation influences their engagement with these word problems is essential for enhancing their comprehension and problem-solving skills in this subject.

2.3.5. The classroom environment

Creating a supportive learning environment is essential for effective teaching and learning (Hattie, 2009). According to Vygotsky's (1978) social constructivism theory, learning is an inherently social process, and the classroom environment should reflect this. In a supportive classroom, learners feel safe to ask questions, express their thoughts, and interact with their peers and the teacher. This social interaction fosters the development of cognitive processes.

The physical layout and design of the classroom can influence learners' engagement and participation (Barrett, Davies, Zhang, & Barrett, 2015). For instance, a well-organised classroom with clear learning centres can encourage independent exploration and problem-solving. In the context of financial mathematics, where learners often work on word problem sums, an organised and conducive environment can enhance the comprehension of complex problems.

The teacher-student relationship is a critical component of the classroom environment (Claessens, van Tartwijk, van der Want, Pennings, Verloop, den Brok & Wubbels, 2017). Effective teachers build positive relationships with their learners, which can lead to greater motivation and engagement. When learners feel connected to their teacher, they are more likely to participate actively in the learning process.

Collaborative learning is an important aspect of a productive classroom environment. Learners working together on tasks and activities, such as solving financial mathematics word problems, can lead to a deeper understanding of the content (Slavin, 2014). Collaboration aligns with Wenger's (2005) theory of community of practice, where learners interact and share knowledge to achieve common objectives.

Effective classroom management is necessary to maintain a positive learning environment. Teachers must establish clear expectations, routines, and rules (Emmer, Evertson & Anderson, 1980 cited in Alter & Haydon, 2017). By maintaining discipline and structure, teachers create a classroom environment where learners can focus on learning, including developing their inference skills in financial mathematics.

2.3.6. The four comprehension strategies used in the IP

2.3.6.1. My turn-your turn

The My turn-your turn comprehension technique is firmly rooted in cooperative learning principles. Cooperative learning, as elucidated by Johnson and Johnson (2017), emphasises positive interdependence, individual accountability, face-to-face interaction, and collaborative skills. In this strategy, learners work together to comprehend text, and each participant's success is intertwined with their peers' achievements (Slavin, 2015). This creates an environment where learners actively engage in discussions, promote critical thinking, and enhance their comprehension skills. Cooperative learning principles like the My turn-your turn strategy employs a variety of critical question types to facilitate the learning process, such as predicting questions, connecting questions, inferencing questions, clarifying questions, and paraphrasing and summarising questions.

For example, predicting questions encourage learners to make informed guesses about what they are going to read. In the context of financial mathematics, learners were presented with a word problem about compound interest and asked, 'Based on the information given, what will the final amount will be after 5 years?' These predictive questions encourage learners to activate their prior knowledge and generate expectations before delving into the text.

Connecting questions guide learners in making connections between the text and their own lived experiences. In the context of exchange rates, learners were prompted with connecting questions like, 'Can you think of a time when Joe (from yesterday's exercise) had to deal with currency exchange while traveling? How was it similar to or different from the scenario presented in this problem?' This type of question fosters engagement by relating the content to familiar situations.

Inference questions require learners to read between the lines and draw conclusions based on evidence from the text. When dealing with taxation problems, one of the inference questions was, 'What can we conclude about the impact of a 14% VAT on the total cost of an item? How does it affect the final price?' This question encouraged the learners to dig deeper into the text and make informed deductions.

Clarification questions are crucial when learners encounter challenging concepts. In a timeline-related word problem, one of clarification questions was, 'Is there anything in the timeline that you find unclear or need further explanation?' This type of question invited learners to seek clarification and ensured a deeper comprehension of the text.

Paraphrasing and summarising questions require learners to rephrase key information from the text in their own words. For instance, after reading about a simple interest problem, a summarising question was posed to the learners: 'Can you summarise the steps involved in calculating simple interest in your own words?' This question promoted active engagement and comprehension by asking learners to articulate their understanding.

This strategy aligns seamlessly with Vygotsky's (1978) social constructivism theory, which underscores the importance of interaction in cognitive development. In the context of the current research, it served as an essential component in the IP designed to improve Grade 10 learners' inference-making skills when tackling financial mathematics word problem sums.

Nomlomo (2010) proposes that the My turn-your turn strategy should extend beyond mere spoken communication to encompass collaborative techniques and learner-centric methods. It encourages learners to actively participate in class activities by taking turns. In this process, the

teacher initiates the exchange by posing questions or giving instructions, while learners respond accordingly. The quality of the questions generated by learners is determined by the responses they provide, fostering a dynamic and thought-provoking classroom environment (Nomlomo, 2010).

The application of the My turn-your turn strategy supports the development of learners' critical thinking abilities and practical skills. By actively participating in discussions and sharing their thoughts, learners learn to think critically about the text they are reading. This not only enhances their comprehension of the material but also encourages them to explore deeper meanings and connections within the text (Kagan & Kagan, 1994). An essential feature of My turn-your turn is its ability to create active, analytical, and socially discussed interactions around the text. It bridges the gap between the learners' individual understanding and the collective comprehension of the group. By actively engaging with the text, learners gain a more profound understanding of its content and structure (Kabilan & Kamaruddin, 2010).

2.3.6.2. Think aloud

The Think aloud strategy is a cognitive approach that enables learners to articulate their thoughts while reading (Afflerbach, 2005). By doing so, learners express their comprehension of the text explicitly, which enhances their metacognitive awareness and understanding of the material (Van Dijk, 2017). This strategy aligns seamlessly with Vygotsky's (1978) theory of social constructivism, as it encourages learners to engage with the text actively.

One of the primary advantages of the Think aloud strategy is its effectiveness in improving reading comprehension. When learners verbalise their thinking, they gain better insight into their cognitive processes, leading to more profound text understanding (Fidan, 2015). Think aloud also promotes self-regulation as learners monitor their comprehension and adjust their strategies as needed, which aligns with metacognitive principles (Flavell, 1979).

Think aloud serves as a metacognitive tool that helps learners reflect on their reading process (Flavell, 1979). They become more conscious of their comprehension, which ultimately contributes to their ability to make inferences from the text (Glenberg, 2011). The metacognitive aspect of this strategy enhances learners' critical thinking skills and self-regulation, making it a valuable tool in the context of financial mathematics.

Think aloud is aligned with Vygotsky's (1978) theory of social constructivism. Through the vocalisation of their thoughts, learners engage with the text in a social context. As they share their insights with peers or teachers, a collaborative understanding of the text is fostered. This

interactive process supports the development of metacognition and deep comprehension, which is a primary focus in the study.

2.3.6.3. Anticipation guides

Adams, Pegg, and Case (2015) introduce the Anticipation guides as a reading comprehension strategy intended to guide learners in understanding text. They not only encourage learners to activate their prior knowledge and experiences, thereby making personal connections with the text, but also provide a set of statements that stimulate and agitate their curiosity, thereby setting a clear purpose for their reading. This critical element adds another layer of engagement and intention to the strategy. The activation of prior knowledge plays a pivotal role in the learners' ability to incorporate new information and ideas into their existing cognitive framework.

Using the Anticipation guide in teaching and learning offers numerous advantages. Adams et al. (2015) emphasise its potential for promoting discussion and group work. This strategy ignites peer interactions and collaboration, which fosters a deeper understanding of the text (Yore, Holliday & Alvermann, 1994). By encouraging learners to relate their personal experiences to the text, the Anticipation guide enriches their comprehension and critical thinking skills.

One of the core principles of the Anticipation guide is the activation of prior knowledge. By connecting new content with what learners already know, this strategy enhances their comprehension (Afflerbach, Pearson, & Paris, 2008). The process of identifying similarities or discrepancies between their existing knowledge and the text requires learners to think critically about the material, fostering a more profound understanding (Marinak, Malloy, Gambrell & Mazzoni, 2015).

The Anticipation guide strategy inherently encourages group discussions and collaborative learning, which supports Vygotsky's (1978) theory of social constructivism. Through discussion, learners share their personal experiences and insights, building a communal understanding of the text. This collaborative environment not only enhances reading comprehension but also develops critical thinking skills and the ability to work with peers.

2.3.6.4. Feature matrix

The Feature matrix strategy is designed to help learners organise and synthesise information from a text by categorising it into a matrix or chart format (Chin & Brown, 2002). By visually representing key features and details, learners can better understand the relationships within the text and identify relevant information more efficiently.

The Feature matrix strategy provides several advantages, making it a powerful tool for enhancing reading comprehension. First, it encourages active engagement with the text, as learners must analyse, categorise, and synthesise information, which aligns with Bloom's taxonomy's higher-order thinking skills. This process promotes deeper understanding and better retention of the material.

Another significant advantage of the Feature matrix strategy is its role in promoting metacognition (Chin & Brown, 2000). As learners create matrices, they reflect on the text's structure, identify the most important elements, and make connections between different pieces of information. This metacognitive approach aligns with Vygotsky's (1978) theory of social constructivism, as learners actively participate in constructing knowledge.

The Feature matrix strategy encourages learners to think critically as they evaluate the significance of various features within a text (Paul & Elder, 2005). They must determine what information is essential, how different elements relate to each other, and what conclusions can be drawn based on the visual representation they create. This critical thinking is essential in financial mathematics, where word problem sums often require learners to identify and use relevant data.

The Feature matrix is well-aligned with Vygotsky's (1978) theory of social constructivism. Through collaborative discussions and sharing of their visual representations, learners engage in a social context that contributes to their learning (Murphy, Wilkinson, Soter, Hennessey, & Alexander, 2009). The strategy fosters a supportive learning environment in which learners collectively make sense of the text.

2.4. Chapter summary

Chapter 2 provides a foundation for the research by outlining the conceptual framework that guides the study. The conceptual framework integrates Vygotsky's theory of social constructivism, Wenger's social theory of learning, and Bloom's taxonomy to provide a comprehensive understanding of the research questions. These theories collectively inform the study's exploration of how social interaction, collaborative learning, and cognitive development occur within the context of teaching inference skills in Grade 10 Financial Mathematics during the ten-week IP. It further delves into a thorough literature review on the key concepts central to the investigation, including inference making, financial mathematics, reading motivation, the classroom environment, and the four comprehension strategies utilised in the IP.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This chapter explores the research paradigm, approach and design employed to investigate the impact of teaching inference skills on the comprehension of word problem sums in Grade 10 Financial Mathematics. The chapter provides a comprehensive overview of the methods and procedures utilised in the research, including the site selection, participant selection, data collection instruments, data analysis, trustworthiness, the researcher's role and finally the ethical considerations.

3.2. Research paradigm

Kivunja and Kuyini (2017) posit that the concept 'paradigm' in educational research refers to the researcher's worldview. It signifies a perspective or set of shared beliefs that guides the interpretation or meaning of research data. They further suggest that paradigms in educational research can be grouped into three main taxonomies, namely positivist, interpretivist, or critical paradigms. This research is underpinned by an interpretivist paradigm.

'In the interpretivism perspective, researchers tend to gain a deeper understanding of the phenomenon and its complexity' (Pham, 2018:3). The phenomenon being explored in this research is the impact of teaching inference skills on the comprehension of word problem sums in Grade 10 Financial Mathematics through a ten-week intervention programme (IP). Adopting an interpretivist paradigm would allow the researcher to go beyond the surface level of numerical problem-solving and delve into the learners' perceptions, understandings and interpretations of inference-making in financial mathematics word problem sums. This approach involves teaching comprehension skills, such as inference making, alongside the mathematical content.

According to Alharahsheh and Pius (2020), the interpretivist paradigm, coupled with qualitative methods, allows researchers to gain a deeper understanding by actively seeking out the experiences and perceptions of a specific social context. The choice of selecting this paradigm was made because it aligns well with a qualitative approach, where data is collected through direct interactions with the participants. Through qualitative methods, such as interviews and observations, the researcher captured the rich and nuanced perspectives of the learners, unveiling valuable insights into the effectiveness and impact of the IP.

3.3. Research approach

The researcher used a qualitative research approach in this study, which has been lauded for its effectiveness in data collection through in-depth engagement with the participants. As noted by Muzari, Shava and Shonhiwa (2022), the qualitative approach is considered ideal for studies like this, as it allows for a deeper understanding of the participants' experiences, perceptions, and behaviours. Through in-depth interviews, work completed during the IP, reflections and observations, the researcher was able to capture rich and nuanced data that provided valuable insights into the learners' comprehension skills, cognitive development, and performance in Grade 10 Financial Mathematics.

The use of qualitative research in this study aligns with the views of Thanh and Thanh (2015), who emphasise that qualitative approaches provide rich reports that are essential for interpretivists seeking to fully comprehend the contexts under investigation. By embracing a qualitative research approach, the researcher was able to delve into the multifaceted perspectives and meanings held by the participants, capturing the intricacies of their experiences during the IP. This approach allowed the researcher to identify patterns, themes, and significant findings within the data, contributing to a comprehensive understanding of the impact of the IP on the learners.

As described by Lichtman (2013), qualitative research involves the organisation, collection and analysis of data acquired from human sources, typically through in-depth interviews and observation. In this study, the researcher meticulously collected and analysed textual data from various sources, including the five Grade 10 learners' reflections, interviews, observations and previous teachers' interviews. This text-based data offered rich contextual details and participants' own words, enabling the researcher to gain deeper insights into the five learners' progress in comprehension skills and higher-order thinking abilities during the IP.

3.4. Research design

The study adopted a case study design, specifically chosen to achieve a comprehensive and in-depth understanding of the research questions at hand. According to Corbin, Strauss, and Strauss (2015), a case study is an investigation of a specific phenomenon that occurs within a well-defined and confined context, referred to as the unit of analysis. In this study, the case under scrutiny is the group of five Grade 10 learners studying financial mathematics in a particular school, designated as School X. These learners were the focal point of analysis, and served as the unit of analysis for this research.

The decision to employ a case study design aligns with the views of Cohen, Manion, and Morrison (2017) and Yin (2018), who assert that case studies are characterised by their specificity, focusing

on a distinct group of participants, a singular setting, and a particular situation or event. In this research, the case study design was well-suited to delve into the unique dynamics of the five Grade 10 learners in School X and their experiences with the process of comprehending financial mathematics problem sums through teaching them inference comprehension skills in order to improve their higher order cognitive abilities.

Yin (2018) further emphasises that single-case studies are not primarily concerned with testing or generating theories or hypotheses. Instead, their main objective is to gain a deeper understanding of a single case, with the overarching aim of drawing insights that can be applied to similar cases. Vogt, Gardner, Haeffele and Baker (2011) echo this perspective, supporting the idea that the ultimate goal of such single-case studies is to contribute to a broader comprehension of similar phenomena in various contexts.

By utilising the case study design, this research endeavoured to explore the intricate nuances and challenges encountered by the group of Grade 10 pupils in School X while tackling financial mathematics problem sums through the lens of teaching inference comprehension skills and developing their higher order thinking skills. This approach allowed for a deep exploration of the learners' perspectives, learning processes, and potential factors that influenced their understanding of the subject matter. Moreover, the findings from this single-case study could be valuable in informing educators, researchers, and policymakers about effective teaching strategies and interventions that may be beneficial for similar groups of learners in the future. The knowledge derived from this study will contribute to a more robust understanding of the complex dynamics involved in teaching financial mathematics to Grade 10 learners, potentially improving overall learning outcomes in this domain.

In their study, Cohen et al. (2017) highlighted various limitations linked to the utilisation of a case study design. The researcher's direct involvement in facilitating the IP gave rise to concerns regarding potential observer bias, subjective comments, and the chance of not fully representing the learners' perceptions. To address these concerns, the researcher made conscious efforts to avoid such pitfalls. Additionally, acknowledging the authority held as the facilitator, the researcher took proactive measures to guarantee that all participants' perspectives were consistently heard and considered throughout the entirety of the study.

3.5. Site selection

In this research project, the chosen site for data collection was a Grade 10 classroom located in School X, a mainstream public high school situated in an urban area within the Western Cape Province. School X falls under the highest national quintile, which is the level 5 category, due to its geographic location in a high socio-economic area (Zondo, Zewotir & North, 2020). As per the Western Cape Education Department (WCED), this categorisation implies that the school is in a high-income earning area and should be able to sustain itself through its school fee policy. However, it is important to note that despite being situated in a financially well-off area, most of the learners attending School X come from surrounding economically disadvantaged areas.

School X is a diverse and multicultural institution with 1063 learners, 95% of whom are South African citizens and 5% from other African countries. English serves as the LoLT at the school. The institution maintains a teacher ratio of 35 learners per teacher. School X places a strong emphasis on extramural activities, encouraging personal growth and teamwork among learners.

The selection of School X as the site for this research project was primarily driven by convenience, as the researcher is a teacher at this school. Cohen et al. (2017:247) explore the concept of convenience sampling for a research site and indicate that 'the researcher selects the sample based on easy accessibility to the participants'. This proximity allowed the researcher easy access to the school environment and ensured practicality in data collection. The familiarity with the school's policies, culture, and administrative procedures proved beneficial in obtaining accurate and reliable data for the study.

The urban location of School X presented certain advantages and challenges for this research project. On the positive side, an urban quintile 5 school setting offered a diverse range of resources and educational opportunities that were beneficial to the learners. However, there were also challenges related to issues such as transportation, safety, and potential distractions for learners. Additionally, the socio-economic disparities between the school's immediate surroundings and the backgrounds of most learners created unique dynamics that may have impacted the learning environment as well as the educational outcomes. Pensiero, Kelly and Bokhove (2020) contend that socio-economic disparities can have an impact on the level of educational support learners receive at home as higher-income parents may be better equipped to assist their children with schoolwork and provide a conducive learning environment.

3.6. Participant selection

Participants for this study were chosen using purposive sampling, a method that involves intentionally selecting individuals based on specific criteria relevant to the research objectives. According to Creswell and Creswell (2022), qualitative research aims to purposively sample participants who will best help the researcher understand the problem and the research question. In this case, the researcher handpicked a group of five learners who had consistently exhibited poor performance in Grade 9 Financial Mathematics. These five learners were identified as the bottom-performing learners in the topic, indicating a clear pattern of struggling with financial mathematics but having potential to improve.

The decision to choose these five learners was made to ensure that the researcher could provide sufficient individualised attention and support to each participant. This decision aligned with Campbell, Greenwood, Prior, Shearer, Walkem, Young, Bywaters and Walker's (2020) notion that a relatively small and purposively elected sample may be employed to increase the depth of understanding. With a smaller group size, the researcher could better understand the unique challenges faced by each learner and tailor interventions accordingly.

Moreover, the sample was enriched by including two previous Mathematics teachers who had taught these selected learners during their Grade 8 and Grade 9 levels. The inclusion of these teachers aimed to shed light on their teaching pedagogies and approaches in developing problem-solving abilities, particularly the skill of inference-making, within the context of financial mathematics.

As Campbell et al. (2020:3) state, 'purposive sampling is used to select respondents that are most likely to yield appropriate and useful information'. The involvement of the two teachers in the sample provided a comprehensive perspective on the learners' academic journey leading up to Grade 10. By analysing the teaching pedagogies employed by these educators and examining the learners' academic backgrounds, the researcher could identify potential areas for improvement and implement targeted interventions to address the learners' challenges effectively.

3.6.1. Description of participants

Table 3.1 shows the demographic information of the five Grade 10 learners, referred to as LA, LB, LC, LD, and LE. Due to research ethics, the actual names of these learners have not been revealed.

Table 3.1 The demographic details of the five Grade 10 learners

| Learners | LA | LB | LC | LD | LE |
|----------------------|----------|-------------|-----------|--------------|--------------|
| Home language | Shona | IsiXhosa | Afrikaans | English | IsiXhosa |
| Age | 17 years | 16 years | 16 years | 16 years | 17 years |
| Gender | Male | Male | Male | Male | Male |
| Year started Grade 8 | 2019 | 2019 | 2019 | 2019 | 2019 |
| Mode of Transport | Train | Private car | Bus | Minibus Taxi | Minibus Taxi |

The learners exhibited diversity in terms of their home language, age, year of starting Grade 8, and mode of transport to school. The school has a rich linguistic mix, with learners' home languages including Shona, IsiXhosa, Afrikaans, and English. This diversity created a multicultural and multilingual environment.

The learners in the classroom had varying ages, with LA and LE both being 17 years old, while LB, LC, and LD were 16 years old. These age differences may have impacted the dynamics of the classroom, as the older learners exhibited different maturity levels and academic strengths compared to their younger counterparts. In one instance, the class was given a difficult group activity. LA and LE took the lead in the activity, which might have been due to the age difference. They may have encountered similar activities in the past and gained valuable skills in time management, task delegation, and group communication. As a result, these differences may have influenced the entire group's learning experiences and perspectives in the classroom setting.

Gender representation among the five learners was uniform, with all of them being male. All five learners started Grade 8 in 2019. This indicates that they had been in high school for three years, highlighting their shared educational journey and suggesting a degree of continuity in their academic experiences. The mode of transport used by the learners to and from school varied, with LA taking the train, LB using a private car, LC using the bus, and both LD and LE relying on a minibus taxi. These different modes of transport led to varied commuting experiences for the learners, affecting their punctuality, attendance, and overall contact engagement. The researcher on a few occasions had to reschedule lessons due to complications in the transport arrangements of the learners using public transport.

Table 3.2 sets out details about the two Grade 10 teachers who were part of the data collection process. They are referred to as TA and TB to maintain anonymity.

Table 3.2 Demographic details of the two teachers involved in this study

| Teachers | TA | TB |
|---------------------------------|----------------------|--------------------------------|
| Age | 46 | 54 |
| Gender | Male | Male |
| Home language | Setswana | English |
| Additional spoken languages | English | Afrikaans |
| Highest qualifications | Diploma in Education | Bachelor of Arts (BA) |
| Collage / University obtained | Hebron College | University of the Western Cape |
| Teaching experience | 24 years | 12 years |
| Teaching experience in Grade 10 | 20 years | 12 years |

Table 3.2 presents the demographics of the two Grade 10 teachers, Teachers TA and TB. Teacher TA is a 46-year-old male educator from a Setswana-speaking household, with a Diploma in Education from Hebron College and 24 years of teaching experience, 20 of which include Grade 10. Teacher TB is 54 years old and uses English as his home language, with Afrikaans as an additional language. He holds a Bachelor of Arts qualification from the University of the Western Cape, and has 12 years teaching experience in grade 10. Both teachers have participated in professional development through workshops and training from the school and the Western Cape Education Department (WCED), enhancing their teaching expertise. Both teachers indicated limited integration of literacy and numeracy in their previous grades' financial mathematics lessons.

3.7. Data collection instruments

The researcher used a variety of data collection methods, including semi-structured interviews with the previous Grade 8 and 9 Mathematics teachers and the five learners. The researcher conducted participant-observations and documentary reviews. Pre- and post-tests, along with an IP were used to assess and teach the learners inference-comprehension skills aimed at developing their thinking skills from lower to higher order.

3.7.1. Semi-structured interviews

The research conducted in this study employed semi-structured interviews as a qualitative data collection method. The interviews aimed to gain insights into the perspectives of both teachers

(Appendix 1 for Grade 8 and 9 teachers) and Grade 10 learners (Appendix 2) regarding financial mathematics performance, teaching pedagogies and teaching inferences. This approach allowed for a deeper exploration of participants' experiences, attitudes, and understandings related to this subject. The chosen method, of using semi-structured interviews, aligned with the recommendations of Creswell and Creswell (2022) and Cohen et al. (2017), who emphasise the importance of allowing respondents to describe their experiences and perspectives in qualitative semi-structured interviews.

According to Creswell and Creswell (2022), qualitative research involves asking open-ended questions about a central phenomenon and using sub-questions to narrow down the focus to specific aspects. This approach was reflected in this study's use of central and probing questions to guide the interviews and explore different facets of financial mathematics learning and teaching.

To collect data from the interviews, the researcher followed recommended practices. Cohen et al. (2017) state that interviews serve the purpose of gaining evidence, data, or information. The researcher employed open-ended questions and probing questions to elicit explicit and detailed responses. This aligns with the semi-structured nature of the interviews, which allowed participants' responses to guide the direction of the conversation while still following the general interview schedule.

When working with the learners, the researcher took deliberate actions based on Morrison's (2013) suggestions to ensure a comfortable and suitable environment for interviews. These actions included using a familiar and comfortable setting like the school classroom, establishing a positive and relaxed atmosphere, emphasising the importance of the participants, and showing sensitivity to the children's needs and perspectives.

In terms of data recording, various methods were used, such as handwritten notes and audiotaping with the agreement of the respondents, and subsequently the recordings were transcribed. This aligns with Creswell and Creswell's (2022) suggestions for recording information from interviews. The researcher ensured that he captured important contextual details like the time, date, location, and the names of both the interviewer and the interviewees. Cohen et al. (2017) emphasise that interviews are intentionally designed events, distinct from naturally unfolding situations. The interview schedule, as highlighted in Tables 3.3, 3.4 and 3.5, outlines the planned timing for interactions with teachers and the group of five learners.

Table 3.3 Interview schedule for the teachers **before** the IP

| | Teacher A | Teacher B |
|----------------------------------|-------------------------------|-------------------------------|
| Interview Date | 15 February 2021 | 15 February 2021 |
| Interview time | 11:30 – 12:30 | 15:30 – 16:30 |
| Interview Day | Monday | Monday |
| Location of the interview | School X in Grade 10A, Room 5 | School X in Grade 10A, Room 5 |
| Language utilised | English | English |

Both teachers were interviewed separately and on the same day using the same interview schedule. Both interviews took between 45 – 60 minutes.

Table 3.4 Interview schedule for the five learners **before** the IP

| | LA | LB | LC | LD | LD |
|----------------------------------|------------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|
| Interview Date | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 |
| Interview Day | Monday | Monday | Monday | Monday | Monday |
| Interview time | 07:30 – 08:00 | 08:00 – 08:30 | 11:30 – 12:00 | 12:00 – 12:30 | 15:00 – 15:30 |
| Location of the interview | School X in Grade 10A Room 5 | School X in Grade 10A, Room 5 | School X in Grade 10A Room 5 | School X in Grade 10A Room 5 | School X in Grade 10A Room 5 |
| Language utilised | English | English | English | English | English |

The five learners were interviewed separately on the same day with each interview taking between 25 – 30 minutes.

Table 3.5 Interview schedule for the teachers **after** the IP

| | Teacher A | Teacher B |
|----------------------------------|-------------------------------|-------------------------------|
| Interview Date | 05 May 2021 | 06 May 2021 |
| Interview time | 11:30 – 12:30 | 11:30 – 12:30 |
| Interview Day | Wednesday | Thursday |
| Location of the interview | School X in Grade 10A, Room 5 | School X in Grade 10A, Room 5 |
| Language utilised | English | English |

Each teacher was interviewed individually on different days, following the same interview schedule. Each interview lasted between 45 to 60 minutes.

In Term 2, after the IP, the researcher decided to use a focus group interview due to time limitations. The focus group interview was conducted to gather common understandings and gauge the opinions of the group of learners regarding their experiences having taken part in the IP (Creswell & Creswell, 2022). The five learners who participated in the focus group interview provided similar and comparable data, which made the study credible. They worked well together as well as with the researcher (Creswell & Creswell, 2022).

Table 3.6 Focus group schedule for the five learners **after** the IP

| | LA | LB | LC | LD | LD |
|----------------------------------|------------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|
| Interview Date | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 | 16. 02. 2021 |
| Interview Day | Monday | Monday | Monday | Monday | Monday |
| Interview time | 11:30 – 12:00 | 11:30 – 12:00 | 11:30 – 12:00 | 11:30 – 12:00 | 11:30 – 12:00 |
| Location of the interview | School X in Grade 10A Room 5 | School X in Grade 10A, Room 5 | School X in Grade 10A Room 5 | School X in Grade 10A Room 5 | School X in Grade 10A Room 5 |
| Language utilised | English | English | English | English | English |

3.7.1.1. Advantages of semi-structured interviews

Using interviews as a research method to collect data offered a range of advantages that contributed to a deeper understanding of participants' perspectives and experiences. Interviews allowed the researcher to gather rich and in-depth data by engaging participants in open-ended

discussions. This qualitative approach aligned with the assertion made by Creswell and Creswell (2022) that interviews allow respondents to describe their experiences in their own words, facilitating a comprehensive exploration of the research topic. The flexibility inherent in interviews enabled the researcher to ask probing questions and delve into unexpected areas of interest, fostering a more nuanced understanding of participants' viewpoints.

Moreover, interviews provided a unique opportunity to access participants' perspectives directly, granting the researcher a window into their worldviews and interpretations. This aligned with Creswell and Creswell's (2022) emphasis on using qualitative sub-questions to narrow down the central phenomenon and explore different facets of it. For example, during interviews with the previous teachers, the researcher would pose additional questions that prompted the teachers to elaborate in more detail or provide illustrative examples. Through open dialogue, the researcher could elicit detailed and personal responses, allowing for a comprehensive exploration of attitudes, emotions, and subjective experiences. In this sense, interviews were a powerful means of giving a voice to the participants and understanding their lived realities.

3.7.1.2. Disadvantages of semi-structured interviews

In addition to their valuable insights, semi-structured interviews as a research method also presented the researcher with several notable disadvantages that required careful consideration. One prominent drawback that emerged was the substantial investment of time and resources that interviews demanded. This inherent challenge was highlighted by Cohen et al. (2017), who underscored that the process of preparing for, conducting, and subsequently transcribing interviews was undeniably laborious and demanding.

3.7.2. Participant observations

In the conducted research, a participant observation approach was employed, aligning with the methodological insights provided by Tesoro (2017), Creswell and Creswell (2022) and Cohen et al. (2017). This approach involved using a structured observation schedule (Appendix 3), as detailed in Table 3.7, to systematically capture data and insights from, and during the IP lessons, enhancing the study's rigor and comprehensiveness.

According to Tesoro (2017), participant-observation stands out as a superior method for data collection due to its autonomy from respondents' willingness to engage and its reduced demands, presenting a notable advantage. In the context of this study, participant-observation emerged as an appropriate approach for data collection, primarily attributed to its ability to yield candid

information. The learners exhibited an authentic demeanour, unrestricted by the need to showcase their best behaviour under observation.

As described by Creswell and Creswell (2022), qualitative observation entails the researcher taking field notes on the behaviour and activities of individuals within the research setting. In this study, the observation schedule served as an observational protocol used by the qualitative researcher to record and document information during the financial mathematics lessons. This schedule guided the researcher's observations and ensured that data collection was consistent and focused on specific aspects such as learner engagement, interactions, and classroom dynamics.

Cohen et al. (2017) emphasise the strength of participant observation in providing rich contextual information and enabling the collection of first-hand data. The goal of utilising participant observation was to monitor how well the five learners understood inference-comprehension skills and to track their understandings of lower order to higher order thinking skills.

In addition to the observation schedule used during the research, observations were also recorded as field notes, aligning with a recommendation by Cohen et al. (2017). These field notes encompassed various levels of description, capturing different aspects of the eight-week teaching phase of the IP. At the basic level, quick jottings of keywords and symbols were noted. Furthermore, detailed descriptions were compiled to provide a comprehensive and coherent account of the observed events.

3.7.2.1. Advantages of being a participant observer

By adopting the role of a participant observer, actively engaging himself in the activities that the five learners were involved in, the researcher achieved a profound immersion within the learning environment. This approach facilitated a first-hand grasp of the dynamics at play, empowering the researcher to comprehensively capture rich data through astute observation, as suggested by Cohen et al. (2017).

The researcher documented reconstructions of conversations and interactions immediately following each lesson in the form of field notes, capitalising on the immediacy of the moment to preserve the data's authenticity. This approach not only ensured the freshness of the information, but also enriched the analysis, fostering a more nuanced and insightful understanding of the intricate dynamics in the lessons and learner engagement.

3.7.2.2. Disadvantages of being a participant observer

A challenge encountered by the researcher pertained to effectively documenting all crucial insights garnered during the active participation in activities, as highlighted by Cohen et al. (2017). Striving to fulfil both the role of an observer and an engaged participant, the researcher found it demanding to meticulously capture every significant detail arising from the observations. This dual engagement occasionally posed a hurdle in comprehensively preserving the richness of the gathered data.

Table 3.7 Details of the observation schedule for the eight-week teaching phase of the IP

| Week | Date | Time | What was being observed? | | |
|------|---------------------------|---------------|--|---|---|
| 2 | 24.02.2021– 25.02.2021 | 15:00 – 16:00 | Involvement in verbal and written tasks. | Comprehension of inference-making abilities and the advancement of cognitive abilities from basic to more advanced thinking skills. | Development of Mathematical problem-solving skills. |
| 3 | 03.03.2021- 04.03.2021 | | | | |
| 4 | 10.03.2021- 11.03.2021 | | | | |
| 5 | 17.03.2021- 18.03.2021 | | | | |
| 6 | 24.03.2021- 25.03.2021 | | | | |
| 7 | 30.03.2021- 31.03.2021 | | | | |
| 8 | 14.04.2021- 15.04.2021 | | | | |
| 9 | 21.04.2021- 22.04.2021 | | | | |

3.7.3. Planned pilot test

Before initiating the pre-test phase, the researcher initially intended to conduct a pilot test involving a different group of five learners (Appendix 4). The purpose was to adequately prepare and verify the appropriateness of the pre-test for the study's participants. However, due to time constraints brought about by the Covid pandemic, the pilot test could not be carried out.

Consequently, the researcher made the decision to refine the pre-test (Appendix 5). This step aimed to ensure that the questions presented were aligned with the subject matter covered in the learners' curriculum and in accordance with the expected knowledge level as outlined in the syllabus. Table 3.8 provides an overview of the modifications adopted from the original test. The adjustments were made to provide clear context, maintain consistency with the scenario, and ensure that the questions align with the revised theme and character details. This helped improve the overall coherence and understanding of the test questions.

Table 3.8 Pre-test modifications

| Question Number | Before Piloting | Adjusted Question | Reason for Adjustment |
|-----------------|--|---|---|
| 1 | Calculate the accrued amount (total) when a principal of P = R1500 is invested at an annual interest rate of 12% for a period of 3 years. | Find the interest charged on a loan of R1500 at 12% per annum (p.a.) for 3 years. | Clarify the context by framing the question in terms of a loan scenario. |
| 2 | A computer costs R5999. Calculate the 10% deposit required. The remaining amount will be paid through equal monthly instalments over a three-year period at a simple interest rate of 14% per annum. Determine the value of each monthly instalment. | A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments. | Provide clearer instructions and specify the concept of a shop and hire purchase agreement. |
| 3.1 | Determine the cash deposit made by John. | What is the value of the deposit? | Make the question more explicit and aligned with common phrasing. |
| 3.2 | Calculate the principal amount John borrows. | Hence, determine the amount Claire borrows. | Change the name and context to align with the updated scenario and character. |

| Question Number | Before Piloting | Adjusted Question | Reason for Adjustment |
|-----------------|--|--|---|
| 3.3 | Find the monthly instalment required to repay the loan. | What will the amount of her monthly instalment be? | Adjust the phrasing to match the changed context and character. |
| 4.1 | The total accumulated amount Sarah will possess after 5 years. | The total amount Amanda will have after 5 years. | Correct the character name and context to match the new scenario. |
| 4.2 | Determine the annual interest received by Sarah. | The interest that Amanda received each year. | Update character details and align with the modified context. |
| 4.3 | Compute the overall interest earned over the given period. | The total interest earned. | Clarify the wording and character consistency based on the adjusted scenario. |

3.7.4. Intervention programme (IP) schedule

Prior to beginning of the IP, the researcher devised a schedule to guide him throughout the ten-week period. This plan, as outlined in Table 3.9, encompassed specific dates, times, the planned Financial Mathematical content, and the comprehension strategies to be employed.

Table 3.9 Details of the IP schedule for each of the ten-week IP

| Week | Date | Time | Mathematical Content | Comprehension Strategy |
|------|------------------------|---------------|----------------------|------------------------|
| 1 | 17.02.2021 | 15:00 – 16:00 | Pre-tests | |
| 2 | 24.02.2021-25.02.2021 | 15:00 – 16:00 | Simple interest | My turn-your turn |
| 3 | 03.03.2021-04.03.2021 | 15:00 – 16:00 | Exchange rates | Think aloud |
| 4 | 10.03.2021- 11.03.2021 | 15:00 – 16:00 | Taxation (VAT) | Anticipation guides |
| 5 | 17.03.2021-18.03.2021 | 15:00 – 16:00 | Compound interest | My turn-your turn |
| 6 | 24.03.2021-25.03.2021 | 15:00 – 16:00 | Discount | Feature matrix |
| 7 | 30.03.2021-31.03.2021 | 15:00 – 16:00 | Timeline | Anticipation guides |
| 8 | 14.04.2021-15.04.2021 | 15:00 – 16:00 | Salary Increase | Feature matrix |
| 9 | 21.04.2021-22.04.2021 | 15:00 – 16:00 | Profit and Loss | Think aloud |
| 10 | 23.04.2021 | 15:00 – 16:00 | Post-tests | |

The commencement and conclusion of the IP schedule saw the initial and final week dedicated to conducting pre- and post-tests respectively. This schedule was thoughtfully designed to assign to each week a specific focus on a distinct area of financial mathematics content derived from the Grade 10 Mathematics curriculum.

Moreover, consideration was given to pairing corresponding inference-comprehension strategies that could amplify the learners' grasp of the targeted content. Strategies such as 'my turn-your turn', 'Think aloud', 'Anticipation guides', and 'Feature matrix' were carefully chosen. These strategies were deployed with the intent to create an interactive and captivating learning atmosphere, fostering both the learners' comprehension of the subject matter and the nurturing of their higher-order cognitive skills, an educational critical pedagogy endorsed by the NDoBE.

The harmonious alignment between the financial mathematics content and the selected comprehension strategies functioned as scaffolding mechanisms for the learners. This strategic alignment aimed to transition the learners from a state of reliance on external assistance to an empowered state of independent learning, a concept resonating from Vygotsky's principles (1978) of scaffolding. The IP schedule ensured a systematic approach to evaluating the impact of the IP on learners' inference-comprehension skills in financial mathematics.

3.7.5. Pre-tests

Before entering the teaching phase of the IP (Weeks 2-9), the refined pre-test (Appendix 5) was administered by the researcher. The pre-test evaluated the financial mathematics problem solving abilities of the five Grade 10 learners, focusing on two specific comprehension skills delineated in the PIRLS document (Mullis, Martin & Sainsbury, 2016). These skills encompassed the capacity to extract explicitly stated information and to make straightforward inferences.

The outcome of the comprehension segment of the pre-test provided valuable insights to the researcher regarding the learners' strengths and areas for improvement in relation to these two types of inference-based comprehension skills. Meanwhile, the outcomes of the financial mathematics component offered a deeper understanding of the learners' grasp of the subject concepts, knowledge, and essential skills.

These pre-test findings were pivotal in shaping the content and direction of the teaching phase of the IP. Guided by these insights, the researcher was able to effectively plan and implement the teaching/input phase over the course of the next 8 weeks. Throughout this teaching/input phase, a diverse array of comprehension strategies and financial mathematics content was employed, as outlined in Table 3.9. This approach was instrumental in effectively teaching and

supporting the learners in acquiring both necessary inference-comprehension and Financial Mathematical proficiencies.

3.7.6. Post-tests

As with the pre-tests prior to the IP, at the end of the eight-week teaching/input period, the researcher conducted the same assessments, called the post-tests. The test assessed financial mathematics word problem sums based on the two comprehension skills outlined in the PIRLS document (Mullis et al. 2016). These comprehension skills included retrieving explicitly stated information and making straightforward inferences. In Chapter 4, the outcomes are contrasted and examined.

3.7.7. Documentary review

Creswell and Creswell (2022) underscore the value of documentary review in accessing information contributed by participants. The researcher used a range of documents to gain a comprehensive understanding of the research context and the unique experiences of the five Grade 10 learners. The central documentary sources encompassed the written work generated by these learners in their books, alongside the pre- and post-test results. These documents served as crucial resources enabling the researcher to assess and analyse the essential phenomena under investigation.

3.7.7.1. Advantages of documentary review

The use of documents created by the Grade 10 learners offered significant benefits in terms of both authenticity and depth of insight (Creswell & Creswell, 2022). The words contained within the learners' written work provided an unmediated portrayal of their thoughts and opinions, increasing the credibility of the study's results. This inherent authenticity played a pivotal role in facilitating the thorough presentation and scrutiny of data, as evidenced by the comprehensive examination of learners' cognitive development and response to the strategies used during the IP in Chapter 4. The ease of access to these documents was further enhanced by the clear identification of learners' names on the materials, which streamlined the process of data collection. The consistent use of these documents throughout the duration of the IP lent continuity and coherence to the amassed data.

3.7.7.2. Disadvantages of documentary review

Despite the substantial advantages linked to the use of documents from the Grade 10 learners, there were certain limitations that needed consideration within the framework of document-based data collection (Creswell & Creswell, 2022). A prominent challenge pertained to the existence of written work that was incomplete. Factors such as the quality of handwriting and occasional grammatical errors introduced potential barriers to a comprehensive understanding of the amassed data

3.8. Data analysis

The researcher followed a systematic and rigorous data analysis process, guided by recommendations from Creswell and Creswell (2022). Cohen et al. (2017) and Wellington (2015). Within this process, the researcher engaged in inductive data analysis, a methodology in which 'patterns, themes, and categories are discovered within the collected data', as described by Patton (2015:542). By adopting the inductive approach, the study aimed to ensure that insights and findings emerged directly from the data itself, enhancing the depth and authenticity of the research process.

Data organisation and preparation constituted the initial step in the data analysis journey. The researcher meticulously organised and prepared the collected data, which included semi-structured interviews with previous Grade 8 and 9 Mathematics teachers, participant-observations, documentary reviews, and the administration of pre- and post-tests as part of the IP targeting learners' inference-comprehension skills in financial mathematics.

Semi-structured interviews provided valuable insights into the perspectives of teachers and learners regarding financial mathematics performance, teaching pedagogies, and inferences. These interviews were conducted with careful attention to encourage participants to openly describe their experiences and viewpoints, aligning with the qualitative approach recommended by Creswell and Creswell (2022) and Cohen et al. (2017).

The researcher transcribed the data obtained from the participants. Following that, the researcher distributed printed duplicates of the transcriptions to the participants, who were then requested to (i) examine and verify the correctness of the transcription; and (ii) ensure that the interpretations correctly reflected their perspectives. Creswell and Creswell (2022) refer to this practise as member checking, in which the researcher seeks confirmation from participants regarding the correctness of their interpretations.

Subsequently, a comprehensive data review, guided by Tesoro's (2017) recommendations in participant-observation methods, was conducted. The researcher's focus during this phase was on comprehending the nuances and contextual factors influencing financial mathematics learning and teaching, and the learners' understanding of inferences. For instance, during participant observations, the researcher closely observed learners' behaviour and engagement during the IP lessons, tracking their cognitive development from lower-order to higher-order thinking skills (Anderson and Krathwohl, 2001).

The researcher incorporated direct quotations from learners into tables, providing concrete examples of their cognitive development. These quotations served as illustrative evidence of how learners applied their knowledge and skills across various levels of Bloom's taxonomy, allowing the researcher to connect specific language and expressions to cognitive processes.

Next, the researcher analysed the cognitive verbs used by the learners in their responses and explanations. These verbs were scrutinised to determine the level of thinking demonstrated by the learners. This provided additional evidence of their cognitive growth. Additionally, participant observation played a pivotal role in this assessment. The researcher closely observed learners' behaviours, participation levels, and social interactions throughout the eight-week teaching phase of the IP. Detailed notes were taken to document their engagement, the questions they asked, the interactions with the learning content and with their peers. This allowed the researcher to gauge the learners' active social involvement in the learning processes which provided valuable insights into their cognitive development.

The researcher employed a systematic coding scheme during the data analysis phase to categorise data segments from various sources, including interview transcripts, participant observation field notes, and documentary materials according to the research inquiries that this investigation is based on. This coding process aimed to identify themes related to financial mathematics performance, pedagogies, and inferences, guided by Creswell and Creswell's (2022) framework.

To answer Research Questions 1 and 3, the data was color coded based on two of the PIRLS comprehension skills as follows:

Table 3.10 Colour coding of data for Research Questions 1 and 3

| PIRLS four comprehension levels | Color coding |
|---|--------------|
| Focus on retrieving explicitly stated information | Yellow |
| Making straightforward inferences | Red |

Regarding Research Question 2, the researcher examined the data in accordance to cognitive development linked to Bloom's taxonomy.

Table 3.11 Data for cognitive growth is colour coded.

| Bloom's taxonomy | Color coding |
|------------------|--------------|
| Remembering | Brown |
| Understanding | Green |
| Applying | Red |
| Analyzing | Blue |
| Evaluating | Orange |
| Creating | Purple |

Emerging themes from the analysis included:

- i. Understanding of inference skills **before** the IP. The pre-tests conducted before the IP assessed the learners' comprehension skills in retrieving explicitly stated information and making straightforward inferences.
- ii. Cognitive development **during** the IP. The eight-week teaching phase of the IP focused on equipping learners with inference-comprehension skills for financial mathematics. Bloom's taxonomy was employed to analyse the learner's cognitive growth, which transitioned from lower to higher-order cognitive skills. They actively engaged with comprehension strategies, shared their understandings, and formed a community of practice, contributing to their cognitive growth.
- iii. Impact of community of practice (CoP). The creation of a CoP played a significant role in the learners' cognitive development. Social interactions facilitated knowledge sharing and scaffolded their understanding of financial mathematics concepts, aligning with Vygotsky's (1978) principles of scaffolding and Wenger et al. (2002).
- iv. Post-test results **at the end** of the IP. The results sought to assess the impact of the IP on the five learners. The post-test assessed financial mathematics word problem sums based on the two comprehension skills outlined in the PIRLS document.

With the identified themes noted, the researcher proceeded to construct a coherent narrative interpretation by connecting them to create meaningful narratives. This process aimed to convey the learners' experiences and cognitive development throughout the IP. For example, the researcher highlighted the transition of learners from reliance on external assistance to becoming independent learners, aligning with Vygotsky's principles of scaffolding (1978). This narrative interpretation added depth and context to the data analysis, consistent with Creswell and Creswell's (2022) recommendations.

The culmination of the data analysis process led to the representation and interpretation of the research findings. Qualitative data were presented in a narrative format, often complemented by chronological accounts, detailed discussions of themes, and illustrative examples featuring quotations. For instance, in response to Research Question 3, the researcher presented post-test results demonstrating an improvement in learners' ability to retrieve explicitly stated information and make straightforward inferences, highlighting the positive impact of the IP on their problem-solving skills in Grade 10 Financial Mathematics.

3.9. Trustworthiness

Cohen et al. (2017) suggest that trustworthiness can be addressed in the validity, reliability and triangulation of data. To demonstrate the trustworthiness of this research, the validity, reliability and triangulation are explored, along with the process of realising these ideas.

3.9.1. Validity

Cohen et al. (2017) and Creswell and Creswell (2022) posit that to enhance the validity of a qualitative research study, it is important to employ a comprehensive approach to ensure that the findings accurately reflect the experiences and perspectives of the participants. The approach employed in this study to enhance validity consists of inductive data analysis, participant-centred presentation, member checking and auditing.

This study exemplified the principle of inductive data analysis through the observation process, as recommended by Cohen et al. (2017). During participant observations, the researcher refrained from imposing predefined categories or expectations on the learners' behaviour. Instead, the researcher engaged in open and unbiased observations, allowing themes and patterns to emerge organically from the learners' actions and interactions in the classroom. For instance, when observing the learners' engagement during the IP lessons, the researcher did not start with a predetermined checklist of expected behaviours. Instead, the researcher closely observed the learners, taking note of their spontaneous reactions, questions, and interactions with the learning content. This approach ensured that the research findings were grounded in the learners' actual behaviours and experiences, rather than being influenced by the teacher's preconceived notions or biases.

To further enhance validity, the researcher adopted a participant-centred perspective throughout the study. As suggested by Cohen et al. (2017), the data were presented in terms of the respondents, with a focus on capturing the situation through their eyes. This approach helped ensure that the research accurately reflected the participants' viewpoints and experiences. For example, when reporting on the interviews with the previous Grade 8 and 9 Mathematics teachers, the researcher presented direct quotations from the teachers, allowing them to articulate their thoughts and experiences in their own words. By doing so, the research findings were presented through the eyes of the participants, ensuring that their viewpoints were accurately conveyed without distortion or bias.

As previously discussed in this chapter, member checking, as advocated by Creswell and Creswell (2022), was utilised to validate the qualitative findings. The researcher distributed printed copies of the transcriptions to the participants for their input. This member checking process allowed participants to confirm the accuracy of the findings, adding another layer of validation to the research. The written data from the study provided in Chapter 4 was reviewed

by the researcher and his supervisors to ensure that the analysis was accurate and free of bias.

3.9.2. Reliability

According to Cohen et al. (2017:273), one approach to addressing reliability is to conduct a structured interview 'with the same format and sequence of words and questions for each respondent'. In alignment with this recommendation, this study employed an identical interview schedule, maintaining uniformity in both questions and probing inquiries, when interviewing the two previous Grade 8 and 9 Mathematics teachers. Yin (2018) further suggests that reliability is a practical metric that assesses the study's consistency and stability. In this study, reliability was further attained since the researcher used the identical timetable for observations throughout the teaching phase of the IP. The researcher employed identical tests for assessing the group of learners in both the pre-tests and post-tests.

3.9.3. Triangulation

Triangulation, as defined by Cohen et al. (2017), is a multifaceted approach that aims to comprehensively explore the richness and complexity of human behaviour by examining it from multiple standpoints. In this study, triangulation was a fundamental methodological strategy employed to enhance the depth and reliability of the research findings. By incorporating space, theoretical, time, and methodological triangulation, the research aimed to provide a comprehensive and reliable understanding of how teaching inference skills influenced Grade 10 learners' comprehension of financial mathematics word problems.

Cohen et al. (2017:266) state that 'space triangulation attempts to overcome the limitations of studies conducted within one culture or subculture'. In this study, the researcher employed space triangulation, extrapolating this definition particularly relating to culture. Wa Thiong'o (1998:13) states that 'language, any language, has a dual character: it is both a means of communication and a carrier of culture'. With this in mind, he used participants who spoke different languages from different cultures to gather his data from five learners and two teachers. LB and LE were isiXhosa speakers, LA was a Shona speaker, LC was an Afrikaans speaker and LD was an English speaker. TA was a Setswana speaker and TB was an English speaker. Theoretical triangulation was accomplished by utilising insights from three theoretical aspects to analyse the data, those of Vygotsky's (1978), Wenger (2005) and Bloom's taxonomy (Anderson & Krathwohl, 2001).

'Time triangulation goes some way to rectifying omissions made by conducting studies at one point only in time'. (Cohen et al. 2017:265). Time triangulation was achieved through the researcher's consistent use of identical observation timetables and pre- and post-tests with the same set of learners throughout the data gathering period. According to Cohen et al.

(2017), triangulation between methodologies entails using many approaches in the study. To accomplish data triangulation, tools for gathering data were employed, including observations, interviews, and examinations of supporting documentation.

3.10. The researcher's role

During data collection, the researcher informed and clearly explained to the participants the purpose of this study. He maintained professionalism by adhering to the rules of research ethics, refraining from discussing or disclosing any information about the respondents to others. Yin (2011) explains that to be transparent in research, a researcher needs to allow for data to be available for inspection from participants in the research. To mitigate bias, the researcher recorded observations, subsequently cross-referencing them with the input provided by the teachers to ensure accuracy. Verbatim transcriptions of the interviews and secure storage of all data collection instruments were undertaken. In order to ensure impartiality and avoid misconceptions regarding study outcomes, the researcher disseminated the findings with the participants for their verification, prioritising their well-being and respect throughout the research process. The researcher was aware of the power position he held as the learners' teacher, recognising the need to establish a distinct environment during the interviews. He worked diligently to foster a positive rapport and atmosphere with the learners.

3.11. Ethical considerations

Curtis, Murphy, and Shields (2014) note that ethical issues represent a set of moral principles that researchers are expected to adhere to. In this study, strict ethical guidelines were observed. Prior to commencing the research, ethical clearance was obtained from the relevant institutions, namely the Cape Peninsula University of Technology (CPUT) (EFEC 13-9/2020) (Appendix 6) and the Western Cape Education Department (WCED) (Appendix 7), to conduct the study in the school. The principal (Appendix 8), two teachers (one example in in Appendix 9), five parents (one example is in Appendix 10) and five learners (one example in in Appendix 11), were provided informed consent forms to sign where they agreed to participate in the study. The researcher was given written authorisation by the principal to collect data at the school. The principal did not take part in the study, but he did sign the consent form of authorisation (Appendix 8) for the researcher to gather data at the school. The researcher followed ethical requirements established in CPUT's Higher Degrees Committee (HDC). Before data collection commenced, all informed consent forms were signed.

In the informed consent documents, the researcher communicated the objective of the research to the principal, teachers, learners, and their parents. Participants were fully informed about the nature of the study and the significance of their contributions to the research. To safeguard anonymity, all participants and the school were provided with pseudonyms, and

their real identities were never disclosed or referenced in any way throughout the study. They were also made aware of their right to withdraw from the study at any stage, ensuring voluntary participation. Recognising the potential for some learners to feel uneasy about their teacher's role as the facilitator of interviews and the IP, the researcher took all necessary precautions to build trust and establish a reciprocal relationship with the learners.

3.12. Chapter summary

Chapter 3 discussed the methodology employed in this research. It addressed the chosen research paradigm, approach and design of this study. Furthermore, it provided insights into site selection, the composition of the study's participant selection, data collection instruments, data analysis, considerations of trustworthiness, the researcher's role and ethical aspects. To respond to the research questions, a combination of interviews, observations, and document analysis was applied. Chapter 4 will subsequently present the analysis and discuss the findings.

CHAPTER 4

FINDINGS AND DISCUSSION

4.1. Introduction

The previous chapter provided the research design and methods used in this study. In this chapter the results of understanding inference skills among five Grade 10 Financial Mathematics learners before, during and after an IP are presented. The results outlined in this chapter address the central research question that guides this study, namely:

What is the impact of teaching inference skills in Grade 10 Financial Mathematics during a ten-week intervention programme (IP)?

The following supporting questions are examined in order to address the central research question:

1. What were the five learners' understandings of inference skills in a Grade 10 Financial Mathematics class **before** the IP?
2. How did the five Grade 10 learners' cognitive abilities evolve **during** the IP?
3. What are the learners' understandings of inference skills **after** the ten-week IP?

4.2. **Research Question 1: What were the five learners' understandings of inference skills in a Grade 10 Financial Mathematics class before the IP?**

Prior to the first week of the IP, five pre-tests were conducted as a diagnostic tool to assist the researcher identify the five learners' understandings of inference skills in the Grade 10 Financial Mathematics sums. The pre-test assessed financial mathematics word problem sums based on two questions posed in the PIRLS (2001, 2006, 2011, & 2016) documents. These questions include retrieving explicitly stated information and making straightforward inferences.

Tables 4.2 – 4.6 present learners' pre-test results and calculations, which breaks down each question according to retrieving explicitly stated information, making straightforward inferences and their mathematical calculation. The mathematical concepts covered in the pre-test are derived from the CAPS curriculum in Grades 7 to 10 are outlined in Table 4.1.

Table 4.1 The financial mathematics curriculum concepts taught in Grades 7 to 10 particular grades

| | Mathematical concepts | Grade 7 | Grade 8 | Grade 9 | Grade 10 |
|----|---------------------------|---------|---------|---------|----------|
| 1. | profit, loss and discount | ✓ | ✓ | ✓ | |
| 2. | budgets | ✓ | ✓ | ✓ | |
| 3. | accounts | ✓ | ✓ | ✓ | |
| 3. | loans | ✓ | ✓ | ✓ | |
| 4. | simple interest | ✓ | ✓ | ✓ | ✓ |
| 5 | hire purchase | | ✓ | ✓ | |
| 6 | exchange rates | | ✓ | ✓ | |
| 7 | commission | | | ✓ | |
| 8 | rentals | | | ✓ | |
| 9 | compound interest | | | ✓ | ✓ |
| 10 | deposits | ✓ | ✓ | ✓ | |

Table 4.1 outlines the financial mathematics curriculum concepts taught in Grades 7 to 10. When the learner reaches Grade 10, it is assumed that all ten concepts outlined have been covered and are known by the learners. The four mathematics questions in the pre-test were formulated on the assumption that the Grade 10 learners knew these concepts.

The five learners were tested on their ability to retrieve explicitly stated information and make straightforward inferences by making correct substitutions from the word problem sums to the relevant formula, such as the simple interest formula and by solving the question posed. Each of the questions presented different scenarios and in order to successfully solve the questions, the learners would have to first retrieve the explicitly stated information by making a correct substitution into the relevant formula. The learners would then have to display that they understood the key-word meaning (inference) of the questions posed by solving the problem correctly.

Each of the five learners' pre-test results are presented in Tables 4.2 to 4.6 outlining what each of the learners scored in every question in relation to retrieving explicitly stated information and making straightforward inferences. The tables are accompanied by a graph and discussion on the performance of each learner. The discussion is linked to the literature and theoretical framework.

4.2.1. Learner A's pre-test results

Table 4.2 shows Learner A's pre-assessment outcomes according to the two comprehension abilities (explicitly stated information in light blue and making straightforward inferences in light green) and how the researcher marked it.

Table 4.2 Learner A's pre-test results

| Learner A – Pre-test results | | | |
|--|--|---|---|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learners' calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) -12% per annum (33.3%)</p> <p>Result: 33.3%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + 12 \times 3)$ $A = R55500$</p> <p>Learner A was not able to convert 12 into a percentage. Further, Learner A could not calculate the interest charged.</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> <p>Result: 80%</p> | <p>$A = P(1 + i \times t)$ $A = R5999(1 + \frac{14}{100} \times 3)$ $A = R8518.58$</p> <p>Instalments = $R8518.58 \div 36$ Instalments = R236.62</p> <p>Learner A could not calculate and subtract the 10% deposit.</p> |

CHAPTER 4 - FINDINGS AND DISCUSSION

| | | | |
|--|--|--|--|
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) -Determine (14.28%) -borrows (14.28%) - monthly instalment (14.28%) ✓</p> <p>Result: 42.84%</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 35000</p> <p>3.3 $A = P(1 + i \times t)$ $A = R35000(1 + \frac{13}{100} \times 3)$ $A = R48650$</p> <p>Instalments = $R48650 \div 36$ Instalments = R1351.38</p> <p>Incorrect calculation of 15% deposit. Learner did not know he had to subtract the deposit from the initial principal amount.</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%) -simple interest (25%) ✓ -total interest earned (25%) -The interest that Amanda received each year (25%)</p> <p>Result: 25%</p> | <p>4.1 $A=P(1+i \times t)$ $A = R25000(1 + 8.5 \times 5)$ $A = R1087500$</p> <p>The conversation of 8.5 into a percentage was not done.</p> |

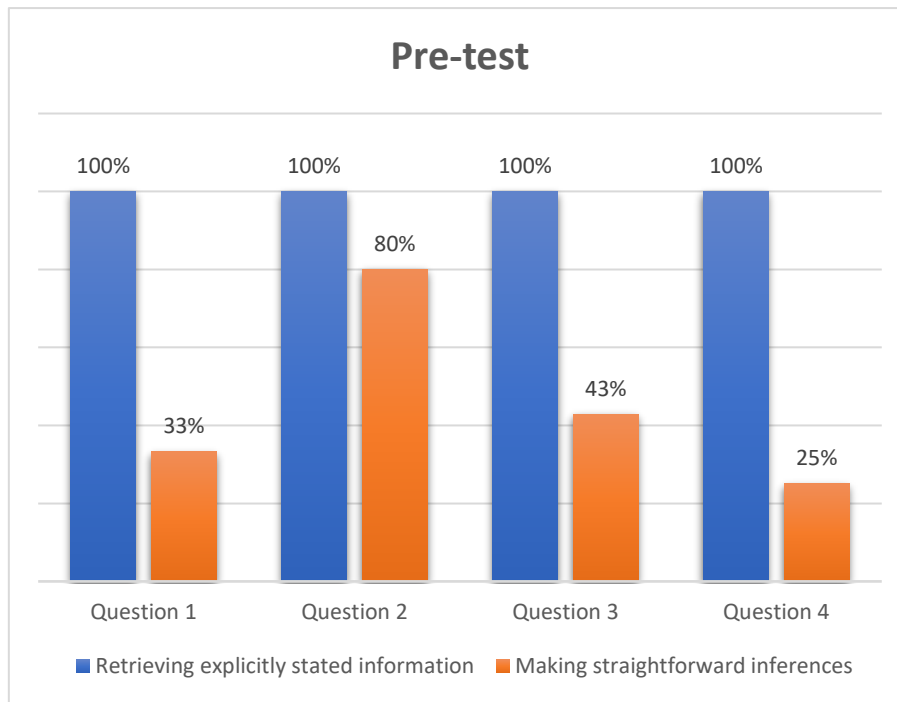


Figure 4.1 Summary of Learner A's pre-test results

For Question 1, Learner A scored 100% for retrieving explicitly stated information. This indicates he understood the meaning of the two concepts being tested in this question such as: 'a loan of R1500 and 3 years'. For making straightforward inferences, Learner A scored 33.3%. This indicates he understood one out of three inferences in the question such as 'Find'. Learner A misunderstood inferences such as 'Interest charged' and '12% per annum'.

Learner A made the following substitution and calculation:

$$\begin{aligned}
 A &= P(1 + i \times t) \\
 A &= R\ 1500(1 + 12 \times 3) \\
 A &= R\ 55500
 \end{aligned}$$

Learner A wrote the correct formula and made the correct substitution for P, which is the principal amount of R1500 for the loan and t, which represents 3 years in the question. The substitution for i was incorrect, as the learner made a substitution of 12 instead of 0.12 or $\frac{12}{100}$. Learner A did not understand that 'percent' means over a 100, i.e., he must divide by 100. Learner A did not understand what 'interest charged' means. In this question it means the difference between the final amount (A) and the principal amount (P). The correct substitution and calculation would have been:

$$A = P(1 + i \times t)$$
$$A = R1500\left(1 + \frac{12}{100} \times 3\right)$$

$$A = R2040$$

$$\text{Interest Charged} = A - P$$
$$\text{Interest Charged} = R2040 - R1500$$
$$\text{Interest Charged} = R540$$

Learner A correctly answered all questions related to retrieving explicitly stated information in Question 2, Question 3 and Question 4. For Question 2, he scored 80% for making straightforward inferences. These results indicate that Learner A did not understand what was meant by '10% deposit'. In Question 3, he scored 42.84% for making straightforward inferences, indicating that he understood concepts such as 'hire purchase agreement', '13% per annum' and 'monthly instalment'; however, did not understand '15% deposit', 'determine' and 'borrows'. Learner A understood one of the four concepts related to making straightforward inferences in Question 4, which is 'simple interest' and attained 25%. Learner A did not understand 'interest rate of 8.5% per annum', 'total interest earned' and 'the interest that Amanda received each year'.

The pre-test results for Learner A show that the learner understood questions related to retrieving explicitly stated information, as he scored 100% in all four questions. However, the results revealed that Learner A struggled to understand inference questions related concepts such as 'deposits' and 'interest earned'.

Prior to conducting the pre-tests, the researcher conducted a semi-structured interview with Learner A's previous (Grade 9) Financial Mathematics teacher to further understand the levels of the performances of the learners and his own experiences of teaching financial mathematics. The following narrative discussion occurred between the researcher and Teacher X:

RESEARCHER: To what extent is language emphasised in your Grade 9 Financial Mathematics classes?

TEACHER X: We underestimate language in Mathematics and sometimes you will say words in class that you expect the learners to know but it's so important to explain the words.

RESEARCHER: What do you mean?

TEACHER X: Because I can tell you, they don't understand the words, they don't understand the meaning of the words.

RESEARCHER: Meaning of the words?

TEACHER X: So, you need – it's so vital that we explain the vocabulary.

Teacher X's admission that learners 'don't understand the meaning of the words' could be a contributing factor in Learner A's poor performance in making straightforward inferences as he did not move from the surface of the texts to understand the meaning of the words. This means Learner A could not integrate terms such as 'deposits' and 'interest earned' with the correct substitution in the calculation.

Vygotsky (1978, cited in Louw, Van Ede & Louw, 1998) refers to a relationship of instruction and development in terms of mediating learning in the ZPD. Vygotsky considered mediating scaffolding, a process by which an adult or a more capable learner (MKO) would work in the child's ZPD to facilitate the child's new learning as critical (Morrell 2015; Girolametto, Weitzman & Greenberg 2012; Vygotsky 1978). After marking the pre-tests, the researcher, as the MKO, made a point of developing Learner A's inference comprehension skills to understand concepts such as 'deposits' and 'interest earned' during the eight-week IP using comprehension strategies such as My turn-your turn, Think aloud and Feature matrix, which are discussed in the second research sub-question.

4.2.2. Learner B's pre-test results

Table 4.3 shows Learner B's pre-assessment outcomes according to the two comprehension abilities (explicitly stated information in light blue, and making straightforward inferences in light green) and how the researcher marked it.

Table 4.3 Learner B's pre-test results

| Learner B – Pre-test results | | | |
|--|--|---|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learners' calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) -12% per annum (33.3%)</p> <p>Result: 33.3%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + 12 \times 3)$ $A = R55500$</p> <p>Learner B was not able to convert 12 into a percentage. Further, Learner B could not calculate the interest charged.</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%)</p> <p>Result: 40%</p> | <p>$A = P(1 + i \times t)$ $A = R5999(1 + 14 \times 3)$ $A = R269955$</p> <p>Instalments = $R269955 \div 36$ Instalments = R7498.75</p> <p>Learner B could not calculate and subtract the 10% deposit. Learner could not convert 14% into the sum. Final monthly instalments were incorrect.</p> |

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|--|--|--|---|
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) -Value of deposit (14.28%) -Determine (14.28%) ✓ -borrows (14.28%) - monthly instalment (14.28%)</p> <p>Result: 28.56%</p> | <p>3.1 $\frac{R35000}{15} = R2333.3$</p> <p>3.2 35000</p> <p>3.3 $A = P(1 + i \times t)$ $A = R35000(1 + 13 \times 3)$ $A = \frac{1470000}{2333.3}$ $A = 630,06$</p> <p>Incorrect calculation of 15% deposit. Learner did not know how to convert 13 into a percentage. No calculation of monthly instalments.</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%) -simple interest (25%) -total interest earned (25%) -The interest that Amanda received each year (25%)</p> <p>Result: 0%</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + 8.5 \times 5)$ $A = R1087500$</p> <p>The conversation of 8.5 into a percentage was not done. No calculation of total interest earned, nor the interest that Amanda received each year.</p> |

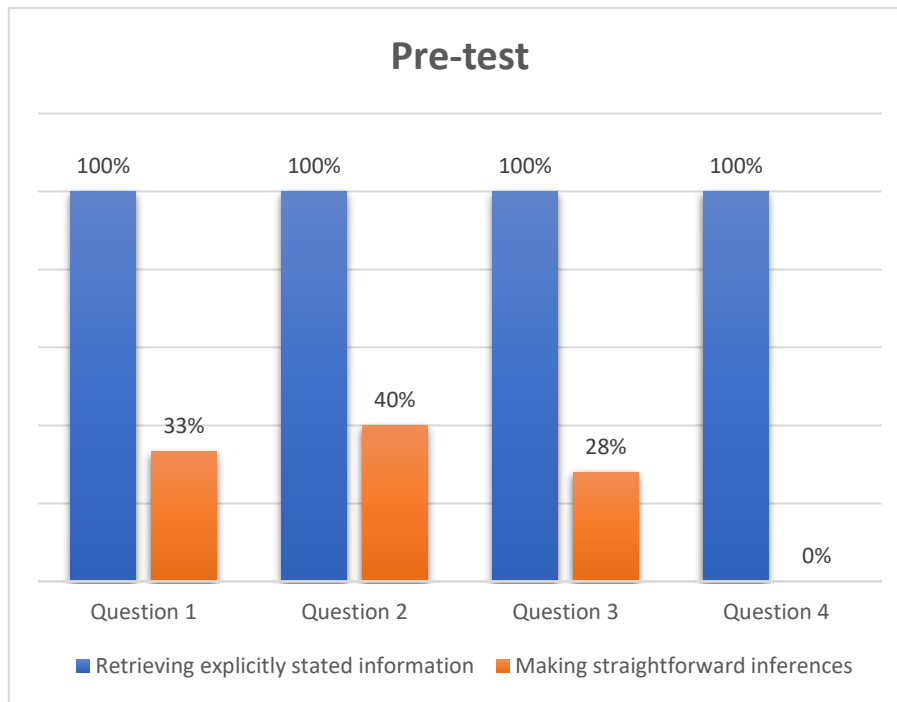


Figure 4.2 Summary of Learner B's pre-test results

Learner B was able to maintain a good achievement in retrieving explicitly stated information in all questions as he scored 100% in all four of the pre-test questions. This indicates he was able to identify and correctly substitute principal amount values like the R1500 loan and year values like 3 years. The pre-test further indicates that Learner B struggled to make straightforward inferences, having scored 33% in the first question, 40% in the second question, 28% in the third question and 0% in question 4.

It is evident from the pre-test that the harder the questions got and the more critical thinking was needed, the worse Learner B performed. He scored an average of 100% on questions that focused on retrieving explicitly stated information and scored an average of 25% for questions that focused on making straightforward inferences.

The researcher conducted a semi-structured interview with Learner B's previous (Grade 9) Financial Mathematics teacher before conducting the pre-tests to ascertain the teachers experience of teaching financial mathematics in the previous year. Learner B's previous teacher was different to Learner A's and was referred to as Teacher Y. The following narrative discussion occurred between the researcher and Teacher Y:

INTERVIEWER: I wanted to check with you in terms of the Grade 9 syllabus that was covered last year. Of course last year would have been a Covid year, would you say that financial mathematics is one of the topics that would have been touched upon in Grade 9?

TEACHER Y: It was touched upon but I would say just on the surface.

INTERVIEWER: On the surface?

TEACHER Y: Not really in depth. Because I think we skipped Hire Purchase and other parts which are part of financial mathematics which I felt we didn't do justice to and obviously now it takes, they do it in Grade 10 as well. So, the basis will permanently be lost so we'll probably have to revisit it now in Grade 10.

Murray (2012) argues that learners find word problems in mathematics more difficult than straight computations, mainly because learners can neither read with understanding nor understand inferences, and therefore do not know what is required of them. The admission by Teacher Y that certain parts of financial mathematics were not covered in the previous year and the basis permanently lost meant that the foundation for financial mathematics had not been properly laid for Learner B. An average score of 25% for questions that focused on making straightforward inferences indicates that Learner B did not understand inferences and did not know what was required of him.

Scaffolding is when learners begin to internalise the new learning of the lesson and assistance is gradually withdrawn. Adults or MKOs help learners to answer difficult questions or to solve problems by asking leading questions (Vygotsky, 1978, cited in Wittmer et al. 2013). During the IP, the researcher, as the MKO, identified that these were areas Learner B needed more attention, so purposefully scaffolded inference-making skills by teaching comprehension strategies during the eight-week IP. These comprehension strategies are discussed in the second sub-question.

4.2.3. Learner C's pre-test results

Table 4.4 shows Learner C's pre-assessment outcomes according to the two comprehension abilities (explicitly stated information in light blue and making straightforward inferences in light green), and how the researcher marked it.

Table 4.4 Learner C's pre-test results

| Learner C – Pre-test results | | | |
|--|--|---|---|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learners' calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$ Interest Charged = $A - P$ Interest Charged = $R2040 - R1500$ Interest Charged = R540</p> <p>Learner C answered all questions correctly.</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> <p>Result: 80%</p> | <p>$A = P(1 + i \times t)$ $A = R5999(1 + \frac{14}{100} \times 3)$ $A = R8518,58$</p> <p>Instalments = $R8518,58 \div 36$ Instalments = R236.62</p> <p>Learner C could not calculate and subtract the 10% deposit.</p> |

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| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> <p>Result: 71.4%</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5205$</p> <p>3.2 $R35000 - R5205 = R29795$</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29795(1 + \frac{13}{100} \times 3)$ $A = R41415.05$</p> <p>Instalments = $R41415.05 \div 36$ Instalments = R1150.42</p> <p>Learner C made an incorrect calculation of the 15% deposit and got an incorrect calculation of the value of the deposit.</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%)</p> <p>Result: 75%</p> | <p>4.1 $A=P(1+i \times t)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = A - P Interest Earned = R35625 - R25000 Interest Earned = R10625</p> <p>Learner C did not attempt question 4.3, which required the calculation of the interest that Amanda received each year.</p> |

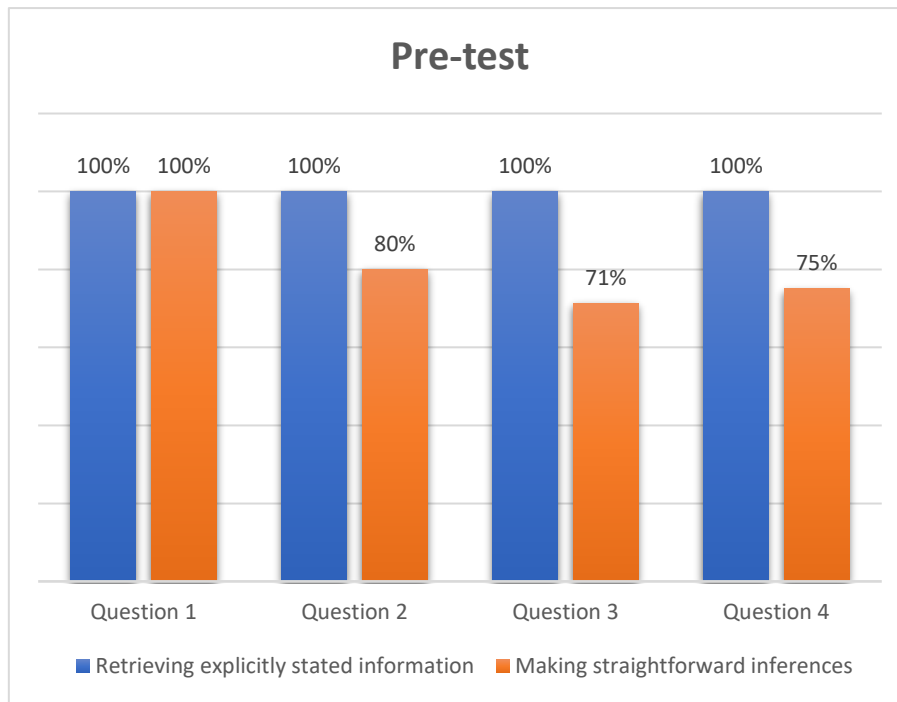


Figure 4.3 Summary of Learner C's pre-test results

Learner C maintained excellent marks in retrieving explicitly stated information in questions 1 to 4 as he scored 100% in the pre-tests. This indicates that he understood concepts that involved identifying and substituting correctly the principal amounts and number of years such as loan R1500 and 3 years. For making straightforward inferences, Learner C scored 100% in question 1, indicating that he understood concepts such as 'interest charged' and '12% per annum'. He scored 80% in question 2, indicating that he did not understand the concept of '10% deposit'. For questions 3 and 4, he scored 71% and 75%, signifying that he did not fully understand the concept of '15% deposit' and how to calculate interest received after each year.

O'Brien et al. (2015) state that inference making is the process of integrating information within texts and between the text and one's general knowledge of the topic. Howie et al. (2017) suggest that making inferences allows readers to move beyond the surface of texts and to resolve the gaps in meaning that often occur in texts. The pre-test reveals that the skill of making straightforward inferences was the weakest of the two comprehension skills that Learner C scored. He struggled to answer questions that involved the concept of 'deposit' as demonstrated by the result of question 2 and could not calculate 'interest received after each year'. This indicates he struggled to integrate information in the questions with his knowledge of financial mathematics, thereby not being able to resolve the gaps in meaning that occurred in the question.

Verenikana (2010:2) describes Vygotsky's ZPD as the 'difference between actual level of development and the higher level of potential development as determined through problem

solving under guidance or in collaboration with more capable peers'. During the IP, the researcher as the MKO guided Learner C to reach a higher level of understanding the terms related to 'making straightforward inference' concepts such as 'deposits' and how to calculate 'interest received after each year'. The comprehension strategies used during the IP are discussed in the second sub-question.

4.2.4. Learner D's pre-test results

Table 4.5 shows Learner D's pre-assessment outcomes according to the two comprehension abilities (explicitly stated information in light blue and making straightforward inferences in light green) and how the researcher marked it.

Table 4.5 Learner D's pre-test results

| Learner D – Pre-test results | | | |
|--|--|--|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) -12% per annum (33.3%) ✓</p> <p>Result: 66.6%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Learner D's calculation of the final amount is correct; however he did not attempt to calculate the interest charged.</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) ✓ - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> <p>Result: 100%</p> | <p>$R5999 \times \frac{10}{100} = 599.9$ Total cost=R5999-10% Total cost=R5999-R599.9 Total cost=R5399.10</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> <p>Monthly Instalments = $R7666,72 \div 36$ Monthly Instalments = R212,96 Learner D calculated the entire question correctly.</p> |

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|--|---|---|--|
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%)✓ -Determine (14.28%) -borrows (14.28%) - monthly instalment (14.28%)</p> <p>Result: 57.12%</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.3 $A = P(1 + i \times t)$</p> <p>$A = R35000(1 + \frac{13}{100} \times 3)$</p> <p>$A = R48650$</p> <p>Monthly Instalments = $R48650 \div 36$ Monthly Instalments = R1351.38</p> <p>Learner D did not attempt the second question. As a result, though the method of calculation is correct, the answer is incorrect.</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%)✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%)✓ -simple interest (25%)✓ -total interest earned (25%) -The interest that Amanda received each year (25%)</p> <p>Result: 50%</p> | <p>4.1 $A=P(1+ixt)$</p> <p>$A = R25000(1 + \frac{18.5}{100} \times 5)$</p> <p>$A = R35625$</p> <p>4.3 $R35625 \div 5 = R7125$</p> <p>Learner D did not attempt the second question. As a result, the last question has been answered incorrectly, though the method is correct.</p> |

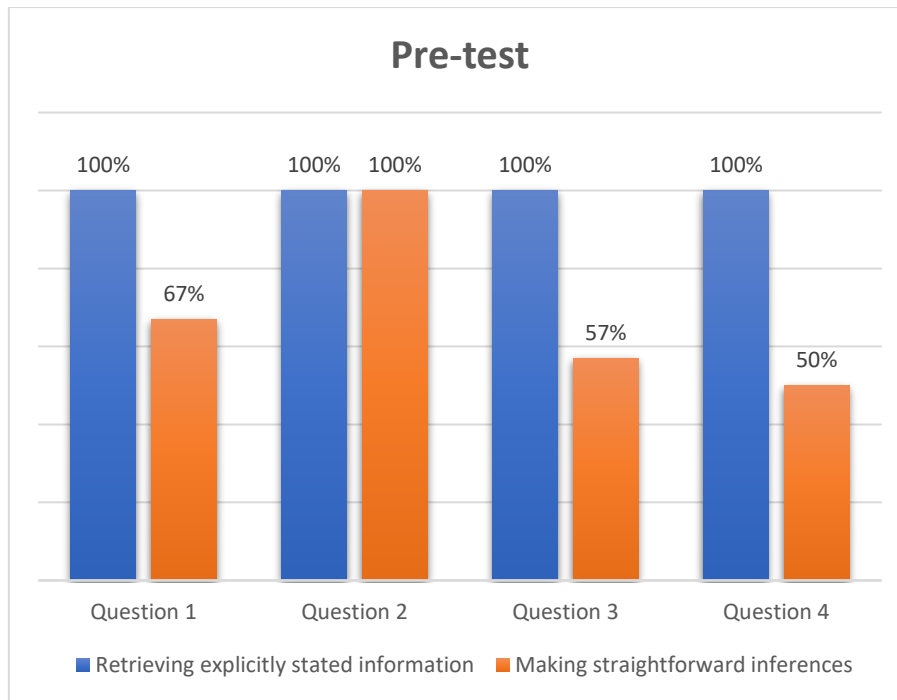


Figure 4.4 Summary of Learner D's pre-test results

Learner D scored full marks for questions pertaining to retrieving explicitly stated information in the pre-tests, with an average of 100% for questions 1 to 4. This indicates that he understood concepts that involved the 'principal amount' and the number of years such as 'R35000 furniture' and '3 years'. For questions pertaining to making straightforward inferences, Learner D scored 66.6% for question 1, indicating that he did not understand the concept of 'interest charged'. In question 2 he scored 100% indicating that he understood concepts such as '10% deposit' and 'find the monthly instalments'. Learner D scored 57% in question 3, which indicates that he did not understand concepts such as 'Determine' and 'borrows'. Learner D scored 50% in question 4, the worst result he attained in the pre-test. This indicates that he did not understand concepts such as 'total interest earned' and 'interest received each year'. The pre-test revealed that Learner D understood retrieving explicitly stated information questions and struggled with 'making straightforward inference' questions.

Vygotsky's (1978) theory of social constructivism emphasises the fundamental function that interaction serves in the growth of a child. According to him, social contacts help the development of cognitive processes and the MKO in scaffolding the learning of children (Vygotsky 1978, cited in Van der Veer, 2014). The researcher developed Learner D's inference comprehension skills in financial mathematics problem sums through social interactions during the IP which will be discussed in more detail in Research Question 2.

4.2.5. Learner E's pre-test results

Table 4.6 shows Learner E's pre-assessment outcomes according to the two comprehension abilities (explicitly stated information in light blue and making straightforward inferences in light green) and how the researcher marked it.

Table 4.6 Learner E's pre-test results

| Learner E – Pre-test results | | | |
|--|--|--|---|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>A = P(1 + i × t) A = R1500(1 + $\frac{12}{100} \times 3$) A = R2040,00 Interest Charged = A – P =R2040-R1500 = R540</p> <p>Learner E answered all questions correctly.</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) ✓ - and the rest will be paid in equal monthly instalments (20%) - at an interest rate of 14% (20%) ✓ -Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%)</p> <p>Result: 60%</p> | <p>$R5999 \times \frac{10}{100} = 599.9$</p> <p>A = P(1 + i × t) A = R5999(1 + $\frac{14}{100} \times 3$) A = R8518.58</p> <p>Learner E correctly calculated the 10% deposit from the principal amount. However, he failed to subtract the deposit from the principal amount. Learner E did not attempt to calculate the monthly instalments.</p> |

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|--|---|---|---|
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%)✓ -Determine (14.28%) -borrows (14.28%) - monthly instalment (14.28%)</p> <p>Result: 57.12%</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$ 3.2 R35000 3.3 $A = P(1 + i \times t)$ $A = R35000(1 + \frac{13}{100} \times 3)$ $A = R48650$</p> <p>Learner E correctly calculated the 15% deposit from the principal amount. However, he could not subtract the deposit from the principal amount to get the amount borrowed. Learner E also did not calculate the monthly instalments.</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%)✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%)✓ -simple interest (25%)✓ -total interest earned (25%) -The interest that Amanda received each year (25%)</p> <p>Result: 50%</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.3 $R35625 \div 5 = R7125$</p> <p>Learner E did not attempt the second question. As a result, the last question has been answered incorrectly, though the method is correct.</p> |

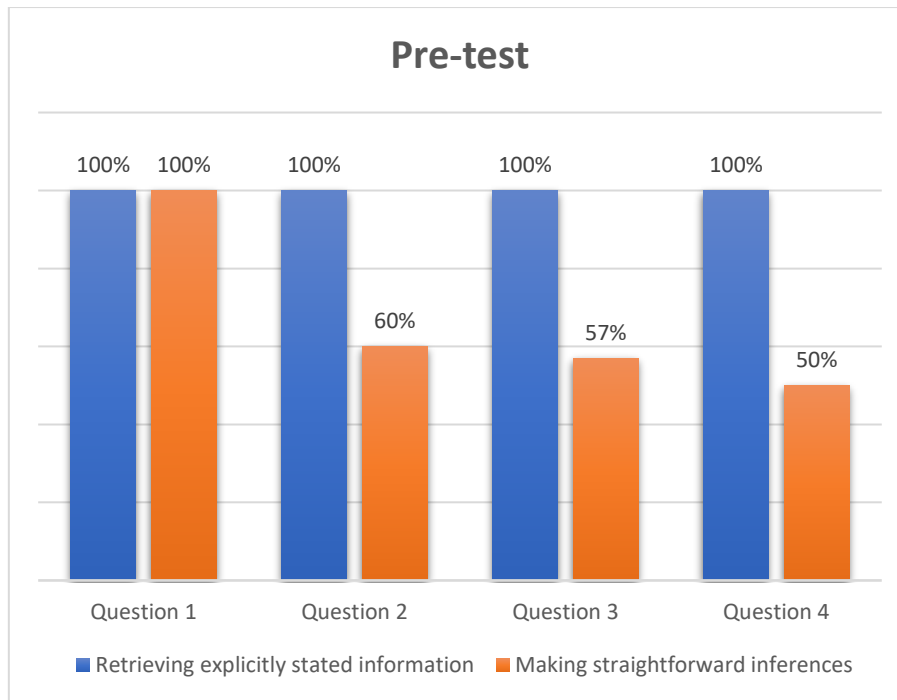


Figure 4.5 Summary of Learner E's pre-test results

Learner E maintained good achievement in retrieving explicitly stated information in all questions, as he scored 100% in all four of the pre-test questions. This indicates he was able to identify and correctly substitute principal amount values like 'R25000 loan' and year values like '5 years'. For making straightforward inferences, Learner E scored 100% in question 1, indicating that he understood concepts such as 'interest charged' and '12% per annum'. He scored 60% in question 2, indicating that he did not understand concepts such as 'monthly instalments'. Learner E scored 57% in question 3, indicating that he did not understand concepts such as '13% per annum', 'borrows' and 'monthly instalment'. For question 4, he scored poorly as he attained a mark of 50%. This indicates that he did not understand half of the concepts that were assessed such as 'total interest earned' and 'interest received each year'. The decline in scores that Learner E attained in questions related to making straightforward inferences reveals that the harder the questions got, the more critical thinking was needed, and the worse Learner E performed.

Khalid and Anjum (2019:9) state that 'through baseline testing we are able to determine our starting point then we start employing interventions and teaching methods'. The results of the pre-test indicated that these concepts needed to be taught to Learner E during the IP. These results formed the baseline test.

Verenikana (2010:4) explains learning in the ZPD as referring to 'performing a range of tasks that the person cannot yet handle alone but can accomplish with the help of instructors or more capable peers'. During the IP, the researcher as the MKO guided Learner E to improve

his understanding of concepts related to 'making straightforward inference' such as 'monthly instalments' and how to calculate 'interest received after each year' by teaching him comprehension strategies. The comprehension strategies used during the IP are discussed in the second sub-question.

4.2.6. Summary

Prior to the IP, the researcher conducted a pre-test which assessed financial mathematics word problem sums of five Grade 10 learners based on two comprehension skills outlined in the PIRLS document. These comprehension skills included retrieving explicitly stated information and making straightforward inferences.

Mullis et al. (2016) describe retrieving explicitly stated information as a process whereby 'readers use various ways to locate and understand content that is relevant to the question posed'. In this pre-test comprehension ability, learners were expected to identify information from the financial mathematics word problem sum that was explicitly stated, and substitute it to the relevant variable of the formula. Learners A, B, C, D and E each attained a mark of 100% in questions related to retrieving explicitly stated information.

Mullis et al. (2016) state that 'Some inferences are straightforward in that they are based primarily on information that is contained in the text, readers may merely need to connect two or more ideas or pieces of information. The ideas themselves may be explicitly stated, but the connection between them is not, and thus must be inferred'. In this pre-test of the comprehension skill, learners were expected to identify information from the question, make a calculation or a conversion and substitute it to the relevant variable of the formula (convert a percentage). In other cases, learners were expected to identify a concept in the question and make a certain calculation (interest charged and deposit).

In this section, Learner A averaged a score of 45.25%, Learner B averaged a score of 25.25%, Learner C averaged a score of 81.5%, Learner D averaged a score of 68.5% and Learner E averaged a score of 66.75%. Together the learners averaged a score of 57.45%.

4.3. Research Question 2: How did the five Grade 10 learners develop cognitively and respond to the strategies used during the IP?

As in Table 4.7, the eight-week teaching phase of the IP was aimed at equipping the five Grade 10 learners with reading comprehension skills that would enable them to better understand and solve financial mathematics problems. The IP consisted of financial mathematics content in Grade 10, taken from the CAPS (2011) document. Each of the weeks was dedicated to one topic of the financial mathematics content in Grade 10. The researcher developed the IP to include comprehension strategies such as My turn-your turn, Anticipation guides, Think aloud and Feature matrix. Each week was aimed at teaching the five Grade 10

learners a comprehension strategy to enable them to solve particular financial mathematics problems related to relevant topic.

Bloom's taxonomy was employed to assess the cognitive advancement of the five Grade 10 learners throughout the eight-week teaching phase of the IP. Forehand (2018) explains Bloom's taxonomy as a methodology for categorising thought processes based on six degrees of cognitive difficulty, ranging from lower-order thinking to higher-order thinking. The lowest three levels are remembering, understanding, and applying, whereas the highest three levels are analysing, evaluating and creating. Tables 4.8-4.12 provide Bloom's thinking development, thinking level, and appropriate verbatim quotes from each learner.


Table 4.7 Outline of the content and comprehension strategies used during the eight-week IP

| Week | Financial Mathematical content taught | Comprehension strategy |
|------|---------------------------------------|------------------------|
| 1 | Pre-tests | |
| 2 | Simple interest | My turn-your turn |
| 3 | Exchange rates | Think aloud |
| 4 | Taxation (VAT) | Anticipation guides |
| 5 | Compound interest | My turn-your turn |
| 6 | Discount | Feature matrix |
| 7 | Timeline | Anticipation guides |
| 8 | Salary Increase | Feature matrix |
| 9 | Profit and Loss | Think aloud |
| 10 | Post-tests | |

A discussion, linking the cognitive development with the relevant comprehension skills that were taught, relevant literature and a discussion on the theory are provided with the presentations of each learner.

4.3.1. Learner A

Table 4.8 Quotations from Learner A indicating his cognitive growth during the eight-week IP

| Thinking development | Thinking level | Verbatim quote from Learner A |
|--|----------------|---|
|  | Remembering | The principal amount refers to the initial amount that was invested by Sizwe. (Week 2, My turn-your turn.) |
| | Understanding | At first, I struggled dealing with deposits but after I saw how sir and other learners did them during their turns, I then understood. (Week 2, My turn-your turn.) |
| | Applying | Once sir showed us how to convert the currencies, I found it easy to do convert currencies on my own. (Week 3, Think aloud.) |
| | Analysing | I disagree with the statement, half-yearly and bi-annually refers to the same thing. (Week 7, Anticipation guide.) |
| | Evaluating | Even though we have calculated the final amount, to find the interest we have to subtract the initial amount from the final amount. (Week 5, My turn-your turn.) |
| | Creating | |
| Lower order | | |
| Higher order | | |

Discussion

Table 4.8 outlines the cognitive development of Learner A from lower-order thinking skills to higher-order thinking skills during the IP. Krathwohl (2002, cited in Sobral, 2021:149) points out that the cognitive skill of remembering refers to retrieving relevant knowledge which includes identifying and recalling. Learner A displayed the cognitive development skill of remembering when he participated in a group activity that utilised the My turn-your turn comprehension strategy during Week 2. The learners had to identify variables of the simple interest formula from the given scenario. Learner A recalled that ‘the principal amount refers to the initial amount that was invested by Sizwe’.

Sobral (2021:149) posits that the cognitive development skill of understanding is associated with ‘determining the meaning of instructional messages, including oral and written communication’. Table 4.8 shows that Learner A understood the concept of deposits, when he participated in a group activity in Week 2. He stated that ‘At first, I struggled in dealing with deposits but after I saw how sir and other learners did them during their turns, I then understood’. This indicates that Learner A’s learning process was scaffolded in the lesson

using the My turn-your turn comprehension strategy which resulted in his understanding the concept of deposits.

Learner A demonstrated that he could apply the skill of converting currencies in Week 3 by being able to complete the activity on his own. Suwanto, Dominik and Arief (2023) link the cognitive skill of application with operative verbs and sequences such as calculate, solve problems and demonstrate. Learner A stated that 'Once sir showed us how to convert the currencies, I found it easy to convert currencies on my own'. He had become proficient at the cognitive skill of application since he was able to do the conversion calculations independently after participating in the Think aloud comprehension strategy. He was encouraged to explain his thought processes when converting the currencies.


Learner A was able to display higher-order cognitive development skills such as analysing and evaluating. Adams et al. (2015: 152) argue that analysis is required to identify the assertions upon which an argument is based and to break down information into its component parts. In Week 7, after participating in the Anticipation guide, he was able to correctly analyse word problem sums by examining and forming an opinion on a given scenario. He stated that 'I disagree with the statement, half-yearly and bi-annually refer to the same thing'. The five learners were asked to read a passage, state whether they agreed or disagreed with the passage and give their reasons. The class would then work through the passage to find the correct answer, after which each learner then had an opportunity to maintain or change their initial justification.

In his list of terms associated with the cognitive skill of evaluating, Adesoji (2018:298) uses words such as 'compares', 'contrasts', 'critiques', 'explains', 'interprets', and 'justifies'. During an activity that utilised the My turn-your turn comprehension strategy in Week 5 of the IP, Learner A argued that 'Even though we have calculated the final amount, to find the interest we have to subtract the initial amount from the final amount'. He was able to evaluate the word problem sum by not just answering the question, but by being able to give a detailed explanation and justification for the answer.

There was no evidence of Learner A reaching the 'Creating' level of cognitive development.

4.3.2. Learner B

Table 4.9 Quotations from Learner B indicating his cognitive growth during the eight-week IP

| Thinking development | Thinking level | Verbatim quote from Learner B |
|--|----------------|--|
| Lower order  | Remembering | The final amount is the total amount that Sizwe will get at the end of the 3 years. (Week 2, My turn-your turn.) |
| | Understanding | 1 euro costs R19,50, the amount in euros must be multiplied by R19,50 to get the equivalent rand value. (Week 3, Think aloud.) |
| | Applying | Getting the percent of a number was easy to do, the text gave us the percent – we just had to divide by 100 and multiply by the number. (Week 6, Feature matrix.) |
| | Analysing | I enjoyed the Feature matrix as I could tell apart on whether the salary increase was done or not. (Week 8, Feature matrix.) |
| | Evaluating | |
| Higher order | Creating | Though the initial price was given, the VAT was not included so the total cost is after the VAT is included, for example if an item is R50, which does not include VAT at 14% then the total cost is after VAT is added. (Week 4, Anticipation guide.) |

Discussion

Adams, Pegg and Case (2015:152) depict the cognitive skill of remembering as the ability to remember distinct, discrete pieces of information, such as facts and definitions. During an activity that utilised the My turn-your turn comprehension strategy in Week 2 of the IP, Learner B demonstrated the cognitive ability of remembering. The learners were tasked to use a provided scenario to identify and find variables of the simple interest formula. Learner B stated that 'The final amount is the total amount that Sizwe will get at end of the 3 years'. He was able to successfully identify the final amount from the activity.

By rephrasing information in their own words, grouping items into categories, contrasting items, or explaining a concept to others, learners demonstrated their understanding of the meaning of the information they encountered (Adams et al. 2015:152). Learner B showed that he understood the concept of exchange rates in Week 3 of the IP. He stated that '1 euro costs R19,50, the amount in euros must be multiplied by R19,50 to get the equivalent rand value'. Learner B correctly explained to the class, in his own words, how to convert currencies in an activity that utilised the Think aloud comprehension strategy.

Adesoji (2018:295) contends that the application cognitive skill refers to using acquired knowledge, facts, and rules to solve problems. Learner B demonstrated the application cognitive skill in Week 6 of the IP. He stated that 'getting the percent of a number was easy to do, the text gave us the percent – we just had to divide by 100 and multiply by the number'. Learner B correctly identified the method of calculating a percentage and subsequently applied this knowledge to calculate the discount.


Analysing refers to separating material into its component pieces and determining how those parts relate to one another and to a larger structure (Sobral, 2021:149). He links analysing with differentiating and distinguishing. During Week 8 in a Feature matrix activity, learners had to compare and contrast whether or not a salary increase had been implemented. Learner B showed he could analyse the content as he correctly differentiated when an increase was implemented and when it was not. He stated 'I enjoyed the Feature matrix as I could tell apart on whether the salary increase was done or not'.

When participants are able 'create', 'design', 'develop', 'discuss' and 'modify' they achieve the cognitive skill of creating as these words are associated with creating (Adesoji, 2018:295). During Week 4 and using the Anticipation guide, Learner B demonstrated the cognitive skill of 'creating'. He correctly disagreed with a given statement by stating that 'Though the initial price was given, the VAT was not included so the total cost is after the VAT is included, for example if an item is R50, which does not include VAT at 14% then the total cost is after VAT is added'. Learner B showed a higher cognitive level; he understood the concept of VAT such that he could state an opinion, agreeing or disagreeing, and explain it and give a practical example of how it was calculated therefore reaching the level of 'creating'.

There was no clear evidence of Learner B reaching the 'Evaluating' level of cognitive development.

4.3.3. Learner C

Table 4.10 Quotations from Learner C indicating his cognitive growth during the eight-week IP

| Thinking development | Thinking level | Verbatim quote from Learner C |
|---|----------------|---|
|  Lower order | Remembering | The interest rate is 8%, it is stated in the question. (Week 2, My turn-your turn.) |
| | Understanding | Profit is the difference between the amount earned and the amount spent, we must subtract the amount spent from the amount earned to get the profit. (Week 9, Think aloud.) |
| | Applying | To solve the problem, I saw that the principal amount is R1500, the interest rate 7% and the number of years the amount was invested is 4 years. I substituted into the formula and calculated the final amount to be R1966,19 (Week 5, My turn-your turn.) |
| | Analysing | We have to know the exchange rate first, we were told 1 euro is R19,50. To convert euros to rands we multiply the euros amount by R19,50 but to convert rands to euros we divide the rand amount by R19,50. (Week 3, Think aloud.) |
| | Evaluating | I disagree. Zinzi is incorrect, she calculated 14% of total R186,55 to be R26,12 which is mathematically correct; however, she forgets to exclude basic foods which are exempt from VAT. The correct VAT amount is R22,05. (Week 4, Anticipation guide.) |
| Higher order | Creating | |

Discussion

‘Remembering may involve recognising, recalling, or reproducing previously learned material’ (Anderson & Krathwohl, 2001:67). In Week 2 of the IP during a My turn-your turn activity based on the financial mathematics topic of simple interest, Learner C was able to correctly retrieve explicitly stated information. During his turn, he correctly stated that ‘the interest rate is 8%, it is stated in the question’. This indicates that he had achieved the cognitive skill of remembering.

According to Anderson and Krathwohl (2001:66), ‘Understanding requires that learners make sense of the material they are processing, either by explaining it in their own words or by finding commonalities and patterns amidst the diversity’. Learner C demonstrated the

cognitive skill of understanding when he participated in a Think aloud exercise in Week 9 of the IP. He explained in his words the concept of profit: 'Profit is the difference between the amount earned and the amount spent, we must subtract the amount spent from the amount earned to get the profit'. By being able to successfully explain in his own words the concept of profit, he indicated that he comprehended and understood the meaning of profit.

Adams et al. (2015:152) argues that the cognitive skill of application 'allows learners to use knowledge, skills, or techniques in new situations'. In Week 5 of the IP, Learner C correctly calculated a compound interest problem to find the final amount. After doing the calculation, he was able to explain his workings to class during a My turn-your turn activity. He stated that 'To solve the problem, I saw that the principal amount is R1500, the interest rate 7% and the number of years the amount was invested is 4 years. I substituted this into the formula and calculated the final amount to be R1966,19'. Learner C used his knowledge of compound interest to substitute the unknown variables and made the correct calculation, demonstrating that he could apply the knowledge of compound interest.


'Analysing involves breaking material into its constituent parts and examining their relationships to one another' (Krathwohl, 2002:37). Learner C was able to correctly analyse the financial mathematics sum that focused on the concept of exchange rates. During a Think aloud activity in Week 3, he stated that 'We have to know the exchange rate first, we were told 1 euro is R19,50. To convert euros to rands we multiply the euros amount by R19,50 but to convert rands to euros we divide the rand amount by R19,50'. Learner C's ability to break down the problem and explain the exchange rate when converting to euros or rands proved that he had a deeper understanding of exchange rates and was able to analyse the word problem.

Adesoji (2018, 295) posits that evaluating refers to 'presenting and defending options by making judgement about information and validity of ideas'. In Week 4 of the IP, Learner C correctly justified his reasoning during an Anticipation guide activity. He stated that 'I disagree. Zinzi is incorrect, she calculated 14% of total R186,55 to be R26,12 which is mathematically correct; however, she forgets to exclude basic foods which are exempt from VAT. The correct VAT amount is R22,05'. Learner C showed a higher level of understanding when calculating VAT. He was able to deconstruct the concept of VAT and make a precise determination of what constituted the correct VAT calculation. This indicated that he could evaluate information.

There was no evidence that Learner C had advanced to the level of cognitive development of Creating.

4.3.4. Learner D

Table 4.11 Quotations from Learner D indicating his cognitive growth during the eight-week IP

| Thinking development | Thinking level | Verbatim quote from Learner D |
|--|----------------|--|
|  | Remembering | The amount that Bongani gets at the end of 7 years is R 6904,30. (Week 2, My turn-your turn.) |
| | Understanding | To determine the amount she must invest, we need to rearrange the formula to make P the subject of the formula (Week 2, My turn-your turn.) |
| | Applying | To calculate the principal loan amount, I firstly calculated the amount for the deposit by saying $\text{deposit} = 4400 \times 10 / 100 = 440$ Then to determine the principal loan amount, we must subtract the deposit amount from the cash price by saying: $P = \text{cash price} - \text{deposit}$ $= 4400 - 440$ $= R 3960,00$ (Week 5, My turn-your turn.) |
| | Analysing | The Brazilian tourists tipped the most. The rand value of their tip was R 179,42. The Japanese tourists tipped the least. The rand value of their tip was R 8,55. (Week 3, Think aloud.) |
| | Evaluating | In compound interest, interest is calculated from the principal amount as well as interest earned from prior periods. This will lead to the banker getting more money for the bank. (Week 5, My turn-your turn.) |
| Higher order | Creating | |

Discussion

Krathwohl (2002:33) explains that ‘examples of remembering include recalling information such as facts, figures, definitions, or concepts’. In Week 2 of the IP, Learner D correctly recalled the final amount from the text. He stated that ‘The amount that Bongani gets at the end of 7 years is R 6904,30’. By recalling the final amount from the text, he demonstrated that he could remember.

Adesoji (2018:298) includes words such as ‘classify’, ‘compare’, ‘demonstrate’, ‘explain’ and ‘illustrate’ in his list of terms associated to the cognitive skill of understanding. Learner D understood the concept of changing the subject of the formula when working with simple interest. In Week 2 during an exercise that utilised the My turn-your turn strategy, he stated

that 'To determine the amount she must invest, we need to rearrange the formula to make (P) the subject of the formula'. By being able to explain how to find the principal amount (P), Learner D demonstrated that he understood the concept of rearranging the simple interest formula.

'Applying knowledge is carrying out or using a procedure in a situation' (Sobral, 2021:149). Learner D successfully applied his knowledge of compound interest when working with the principal amount. He correctly calculated the principal amount and explained it by stating that 'to calculate the principal loan amount, I firstly calculated the amount for the deposit by saying deposit = $4400 \times 10 / 100 = 440$. Then to determine the principal loan amount, we must subtract the deposit amount from the cash price by saying:

$$\begin{aligned} P &= \text{cash price} - \text{deposit} \\ &= 4400 - 440 \\ &= \text{R } 3960,00'. \end{aligned}$$


Nayef, Yaacob and Ismail (2013:168) state that 'Analysis distinguishes between facts and inferences and determines how the parts relate to one another and to an overall structure'. In Week 3 of the IP, Learner D correctly analysed a problem sum by being able to break down the question to determine the rand value of the different groups of tourists. When he had done these calculations, he was able to determine which group tipped the most. During the Think aloud exercise he stated that 'The Brazilian tourists tipped the most. The rand value of their tip was R 179,42. The Japanese tourists tipped the least. The rand value of their tip was R 8,55'.

'Evaluation involves making judgments based on criteria and standards'. (Anderson & Krathwohl, 2019:72). During a My turn-your turn activity in Week 5, Learner D accurately evaluated a problem sum. He stated that 'In compound interest, Interest is calculated from the principal amount as well as interest earned from prior periods. This will lead to the banker getting more money for the bank'. By being able to correctly explain and break down the concept of compound interest, Learner D arrives at the accurate conclusion and demonstrates to have been able to 'evaluate'.

There was no evidence that Learner D had advanced to the level of cognitive development of Creating.

4.3.5. Learner E

Table 4.12 Quotations from Learner E indicating his cognitive growth during the eight-week IP

| Thinking development | Thinking level | Verbatim quote from Learner E |
|--|----------------|---|
|  | Remembering | The unknown variable is the (P) principal amount. It is stated in the question. (Week 5, My turn-your turn.) |
| | Understanding | The third question says that the investment grew at a simple interest rate, so we must use the simple interest formula. To calculate the interest rate, we need to make (i) the subject of the formula. (Week 2, My turn-your turn.) |
| | Applying | To get how much the iPod cost in rands, if she buys it now, we have to multiply the cost in pounds by the exchange rate. By saying: Cost in rands = (cost in pounds) × exchange rate. (Week 3, Think aloud.) |
| | Analysing | |
| | Evaluating | In simple interest, the interest is only calculated on the principal amount and not on the interest earned during prior periods. This will lead to the borrower paying less interest. (Week 2, My turn-your turn.) |
| Higher order | Creating | The difference between the selling price and the cost is profit. For example, if we buy the bag of 90 chocolates for R333 and we sell them for R4 each, the difference between income and expenses is: $R360 - R333 = R27$. Therefore, we make R27 profit from selling the chocolates. (Week 9, Think aloud) |

Discussion

Adesoji (2018:295) describes learners who demonstrate the cognitive skill of remembering to ‘exhibit memory of previously learned material by recalling facts and concepts’. In Week 5 of the IP, Learner E was able to retrieve explicitly stated information in the question. During a My turn-your turn activity he stated that ‘The unknown variable is the (P) principal amount. It is stated in the question’.

‘Understanding is the ability to grasp the meaning of information by interpreting and translating what has been learned’ (Nayef et al. 2013:171). Learner E showed that he understood when to use the simple interest formula. During a My turn-your turn exercise in Week 2, he stated

that 'The third question says that the investment grew at a simple interest rate, so we must use the simple interest formula. To calculate the interest rate, we need to make (i) the subject of the formula'. By being able to explain in his own words how to utilise the simple interest formula, Learner E displayed the cognitive skill of understanding.

According to Anderson and Krathwohl (2001:68), 'Application involves the use of prior knowledge and strategies to solve problems, complete tasks, or carry out projects'. Learner E demonstrated the cognitive skill of application when working with exchange rates in Week 3 of the IP. In a Think aloud exercise he stated that 'To get how much the iPod cost in rands, if she buys it now, we have to multiply the cost in pounds by the exchange rate. By saying: Cost in rands = (cost in pounds) × exchange rate'. Learner E was able to use his prior knowledge of exchange rates to correctly outline how to calculate the cost of the iPod in rands, thereby showcasing the cognitive skill of application.

Nayef et al. (2013) associates the cognitive skill of evaluation with learners' ability to 'assess', 'evaluate', 'prioritise', 'predict' and 'justify'. Learner E was able to evaluate when working with the concept of simple interest. In a My turn-your turn activity in Week 2, he stated that 'In simple interest, the interest is only calculated on the principal amount and not on the interest earned during prior periods. This will lead to the borrower paying less interest'. His ability to comprehensively explain the concept of simple interest in his own words and justify his reasons demonstrates that he could evaluate.

'Creating requires using existing knowledge and skills to generate a new, original product or idea. It involves synthesising information, ideas, or elements into a new whole' (Anderson & Krathwohl, 2001:154). In Week 9 of the IP, whilst working on a Think aloud activity, Learner E demonstrated the cognitive skill of 'creating'. He stated that 'the difference between the selling price and the cost is profit. For example, if we buy the bag of 90 chocolates for R333 and we sell them for R4 each, the difference between income and expenses is: $R360 - R333 = R27$. Therefore, we make R27 profit from selling the chocolates'. Learner E was able to generate a relevant example from existing knowledge there achieving the cognitive skill of creating.

There was no clear evidence of Learner E demonstrating the cognitive skill of analysing.

4.3.6. Summary

Throughout the teaching phase of the IP, the group of learners developed cognitively in understanding and calculating Grade 10 Financial Mathematics content. The learners progressed from basic to advanced cognitive abilities by learning and completing activities that used comprehension strategies taught in the IP classes. When these five learners participated in the comprehension activities in the main class, they started sharing their

opinions and their understandings of the different topics with the rest of the class. The learners started to learn from each other and a community of practise (CoP) was created.

One of the key features of CoP is that it is a social learning process. Wenger et al. (2002) argue that learning is not just an individual process but is heavily influenced by social interactions. They contend that learning occurs when individuals engage in a learning community, where they can share knowledge, skills, experiences, and ideas. The CoP that was created provided a platform for the learners to engage in learning and to increase their knowledge and skills through interactions with the rest of the class. Vygotsky (1978) suggests that the presence of an MKO can help to scaffold the learner's understanding and facilitate their development (Vygotsky 1978, cited in Van der Veer, 2014). The researcher as the MKO taught the class different comprehension strategies through activities that the learners had to complete. The learning process of the learners was scaffolded by both the researcher and the CoP that was created.

In terms of cognitive development, according to Bloom's taxonomy, all five learners demonstrated that they understood the lower-order thinking skills in the taxonomy, namely remembering, understanding and application in their mathematics problem sums. The achievement of the higher-order thinking skills, analysing, evaluating and creating, varied in the group. All learners with the exception of Learner E demonstrated clear examples of analysis as recorded by the researcher. Learner B could not demonstrate the cognitive level of evaluation, whilst all four other learners were able to evaluate. The last level of the higher-order thinking skills and taxonomy is that of creating. Learner B and Learner E achieved the cognitive level of creating and showed an advanced level of understanding of the relevant concepts such that they could succinctly explain, analyse and give relevant examples on their own. Overall, the five learners progressed from basic to advanced cognitive abilities as demonstrated by how they performed in the IP.

4.4. Research Question 3: What were the five learners' understandings of inference skills in a Grade 10 Financial Mathematics class after the IP?

As with the pre-tests prior to the IP, at the end of the eight-week teaching period, the researcher conducted the same assessment in the post-test. The test assessed financial mathematics word problem sums based on two comprehension skills outlined in the PIRLS document. These comprehension skills included retrieving explicitly stated information and making straightforward inferences.

Each of the five learners' post-test results are presented in Tables 4.13 to 4.17, outlining what each of the learners scored in every question in relation to retrieving explicitly stated

information and making straightforward inferences. The tables are accompanied by a graph and discussion on the performance of each learner.

4.4.1. Learner A's post-test results

Table 4.13 shows Learner A's post-test results based on the two comprehension skills (explicitly stated information in light blue and making straightforward inferences in light green) and how the researcher marked it.

Table 4.13 Learner A's post-test results

| Learner A – Post-test results | | | |
|--|--|--|---|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Interest Charged = $A - P$ Interest Charged = $R2040 - R1500$ Interest Charged = R540</p> <p>Correct calculation</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>- 10% deposit (20%) - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> <p>Result: 100%</p> | <p>$R5999 \times \frac{10}{100} = 599.9$ Total cost = $R5999 - 10\%$ Total cost = $R5999 - R599.9$ Total cost = $R5399.10$</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> <p>Monthly Instalments = $R7666,72 \div 36$ Monthly Instalments = R212</p> |

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| | | | |
|--|---|--|--|
| | | | Correct calculation and answer, however the learner omitted the decimal part of the answer (R212,96) |
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> <p>Result: 100%</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> <p>Result: 100%</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 Amount to borrow = R35000 - 15% Amount to borrow = R35000 - R5250 Amount to borrow = R29750</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29750(1 + \frac{13}{100} \times 3)$ $A = R41352,50$</p> <p>Monthly Instalments = R41352,50 ÷ 36 Monthly Instalments = R1148,68 Correct calculation</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> <p>Result: 100%</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%) ✓</p> <p>Result: 100%</p> | <p>4.1 $A=P(1+i \times t)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = A - P Interest Earned = R35625 - R25000 Interest Earned = R10625</p> <p>4.1 $R10625 \div 5 = R2125$ Correct calculation</p> |

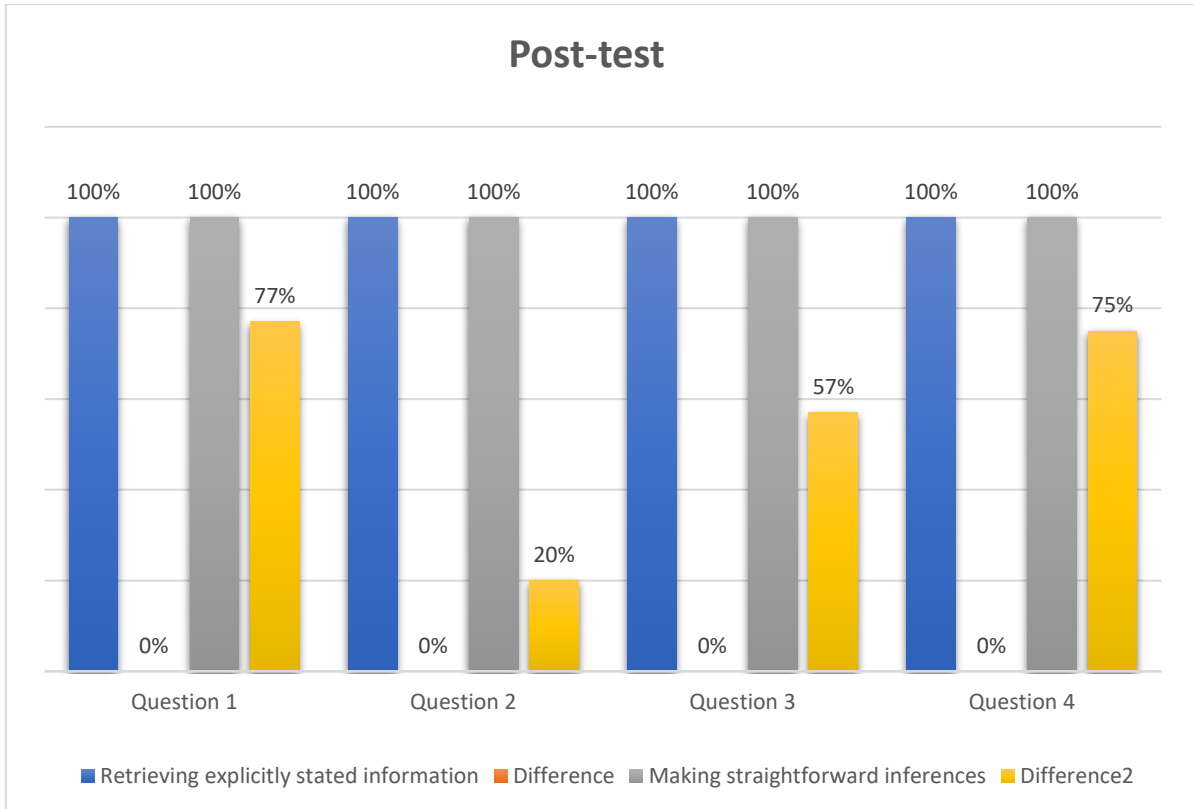


Figure 4.6 Summary of Learner A's post-tests results

The post-test results for Learner A showed that he understood questions related to retrieving explicitly stated information as he scored 100% in all four questions. This was important as it formed the first step to correctly calculating the word problem sums, to progressing through Bloom's taxonomy more complex cognitive skills and understanding what the questions implied. Learner A maintained the 100% score for retrieving explicitly stated information from the pre-tests. The post-test results further revealed that Learner A made an improvement in questions related to making straightforward inferences and that he now understood related concepts such as 'deposits' and 'interest earned'.

For making straightforward inferences in Question 1, Learner A had an improvement of 77%. This indicates that whereas in the pre-test he did not understand concepts such as 'Interest charged' and '12% per annum' yet in the post-test he showed a deeper understanding of all three inferences in the question such as 'Find', 'Interest charged' and '12% per annum'. In Question 2, he had an improvement of 20% in making straightforward inference questions. This meant that he now understood the concept of deposits and what was meant by '10% deposit'. He improved by 57% in Question 3. In the pre-test he scored 42.84% for making straightforward inferences and in the post-test, he scored 100%. This indicates that he now understood concepts such as '15% deposit', 'determine' and 'borrows'. Learner A made a 75% improvement in the post-test for making straightforward inferences in Question 4. In the pre-

test he understood only one of the four concepts related to making straightforward inferences which was 'simple interest'. In the post-test he scored 100%, indicating that he now understood inferences such as 'interest rate of 8.5% per annum', 'total interest earned' and 'the interest that Amanda received each year'. There was no improvement for retrieving explicitly stated information, as Learner A maintained a score of 100%.

Learner A scored 100% in the post-test for both retrieving explicitly stated information and making straightforward inferences. This indicates that, after the IP, he could recall relevant information that was stated in the questions and he understood the financial mathematics concepts that were being assessed. The post-test revealed that Learner A was able to correctly work out the calculations, meaning he could apply his knowledge of financial mathematics to the current word problems. The post-test also revealed that Learner A demonstrated higher-order thinking skills as some of the questions required the learners to analyse and evaluate.

4.4.2. Learner B

Table 4.14 Learner B's post-test results

| Learner B – Post-test results | | | |
|--|--|---|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Interest Charged = A – P Interest Charged=R2040-R1500 Interest Charged = R540</p> <p>Correct calculation</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> | <p>- 10% deposit (20%) - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ -Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> | <p>$R5999 \times \frac{10}{100} = 599,9$ Total cost=R5999-10% Total cost=R5999-R599,9 Total cost=R5399,10</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> |

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| | | | |
|--|--|--|--|
| | Result: 100% | Result: 100% | <p>Monthly Instalments = $R7666,72 \div 36$ Monthly Instalments = R212,96 Correct calculation</p> |
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 Amount to borrow = $R35000 - 15\%$ Amount to borrow = $R35000 - R5250$ Amount to borrow = R29750</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29750(1 + \frac{13}{100} \times 3)$ $A = R41352,50$</p> <p>Monthly Instalments = $R41352,50 \div 36$ Monthly Instalments = R1148,68</p> <p>Correct calculation</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%) ✓</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = $A - P$ Interest Earned = $R35625 - R25000$ Interest Earned = R10625</p> <p>4.2 $R10625 \div 5 = R2125$</p> <p>Correct calculation</p> |
| | Result: 100% | Result: 100% | |

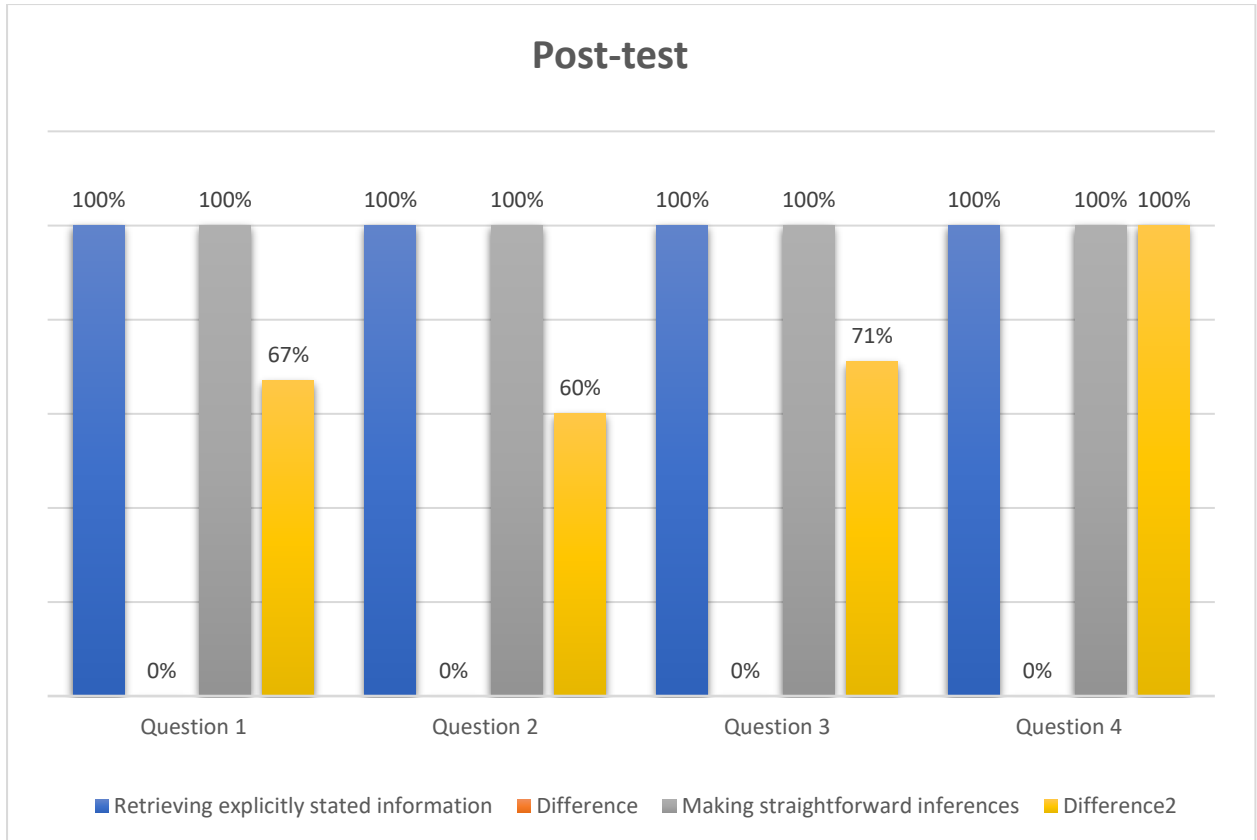


Figure 4.7 Summary of Learner B's post-test results

According to Learner B's post-test results, he understood questions about retrieving explicitly stated information as he received a score of 100% on each of the four questions. This was important because without the ability to retrieve explicitly stated information, he would not have been able to perform accurate calculations. Learner B maintained the 100% score he attained in the pre-tests for the financial mathematics word problem sums based on the first comprehension skill: retrieving explicitly stated information.

The post-test results showed that Learner B improved on questions related to making straightforward inferences. In the pre-tests he had made an average score of 25% for questions that focused on making straightforward inferences and in the post-test, he attained a score of 100% for all four questions. He made a 67% improvement for making straightforward inferences in Question 1, indicating that he now understood concepts such as 'interest charged' and '12% per annum'. In Question 2 of the post-test, he improved by 60% for making straightforward inferences and received a perfect score of 100%, indicating that he understood all five inference concepts, including '10% deposit', 'equal monthly instalments', 'interest rate of 14%' and 'find the monthly instalments' that he got wrong in the pre-test. In Question 3 of the pre-test, Learner B got 2 out of the 8 inference concepts correct and made a 71% improvement to score 100% in the post-test. This signals that he now understood concepts such as '15% deposit', 'interest rate', 'value of deposit', 'borrows' and 'monthly

instalment'. Learner B did not understand any of the inference concepts in Question 4 of the pre-test; however in the post-test he attained a score of 100% meaning that he had understood concepts such as 'interest rate of 8.5% per annum', 'simple interest', 'total interest earned' and 'interest that was received each year'.

Learner B's post-test results showed that he understood questions about retrieving explicitly stated information and making straightforward inferences. He also improved on questions related to inference concepts such as 'interest charged', 'interest rate ' and 'monthly instalments'. The post-test revealed that Learner B was able to demonstrate higher order thinking skills such as analysing, evaluating and creating when working with financial mathematics word problem sums.

4.4.3. Learner C

Table 4.15 Learner C's post-test results

| Learner C – Post-test results | | | |
|--|--|---|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Interest Charged = A – P Interest Charged=R2040-R1500 Interest Charged = R540</p> <p>Correct calculation</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> | <p>- 10% deposit (20%) ✓ - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ -Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> | <p>$R5999 \times \frac{10}{100} = 599.9$ Total cost=R5999-10% Total cost=R5999-R599.9 Total cost=R5399.10</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> |

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| | | | |
|--|--|--|--|
| | Result: 100% | Result: 100% | <p>Monthly Instalments = $R7666,72 \div 36$ Monthly Instalments = R212,96 Correct calculation</p> |
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 Amount to borrow = $R35000 - 15\%$ Amount to borrow = $R35000 - R5250$ Amount to borrow = R29750</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29750(1 + \frac{13}{100} \times 3)$ $A = R41352,50$</p> <p>Monthly Instalments = $R41352,50 \div 36$ Monthly Instalments = R1148,68</p> <p>Correct calculation</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%) ✓</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = $A - P$ Interest Earned = $R35625 - R25000$ Interest Earned = R10625</p> <p>4.3 $R10625 \div 5 = R2125$</p> <p>Correct calculation</p> |
| | Result: 100% | Result: 100% | |

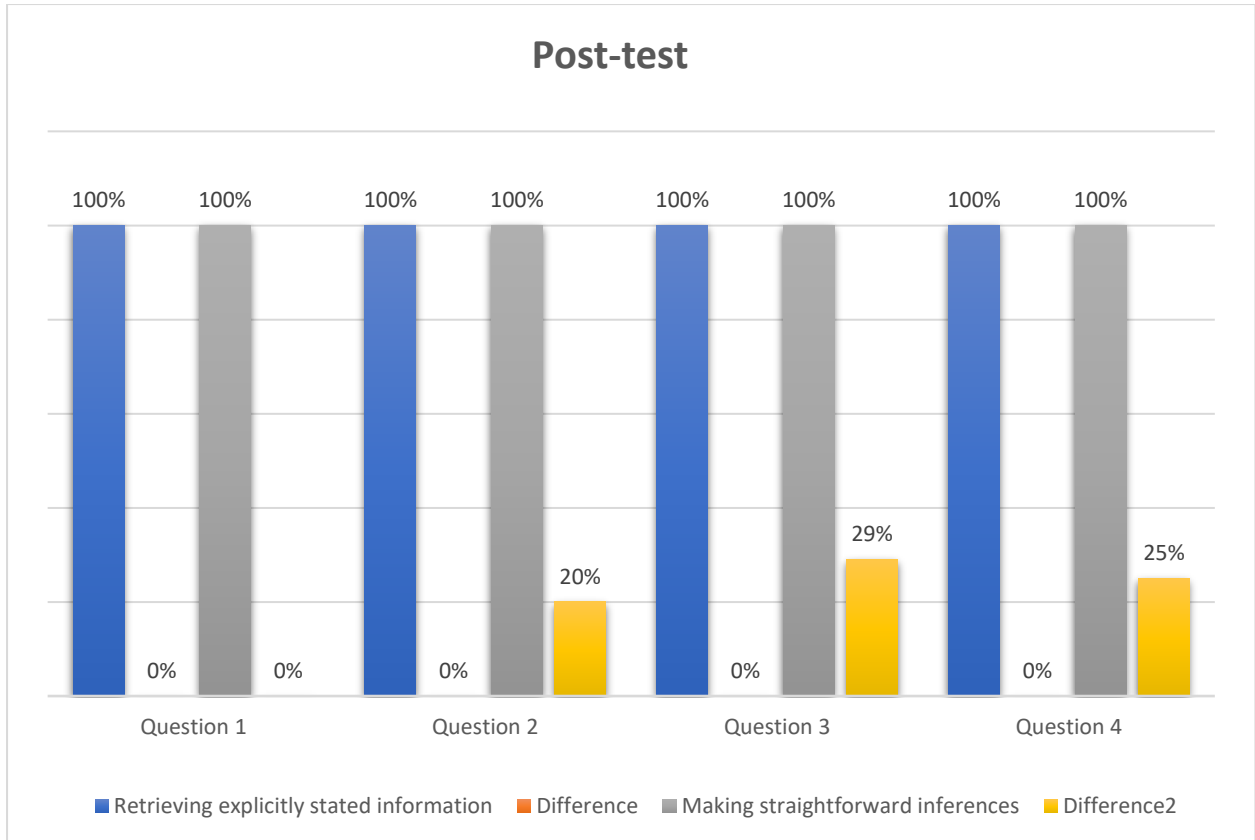


Figure 4.8 Summary of Learner C’s post-test results

The post-test results for Learner C reveal that he understood questions related to retrieving explicitly stated information. He scored 100% in the post-test in all four questions, maintaining the perfect score he had achieved in the pre-test for this section. This indicates that he had mastered the foundational comprehension skill of retrieving directly stated information from the word problem sums and was ready for higher-level comprehension skills such as making straightforward inferences to correctly comprehend and calculate the financial mathematics sums.

There was an improvement in the questions that required Learner C to make straightforward inferences. In the post-test results for Question 1, he maintained a score of 100% attained in the pre-test. This indicated that he understood concepts such as ‘interest charged’ and ‘12% per annum’. In Question 2 of the post-test, he recorded a 20% improvement to attain a score of 100%. Whereas in the pre-test he did not understand concepts such as ‘10% deposit’ yet by the end of the post-test he understood all five inference concepts in Question 2, including ‘equal monthly instalments’, ‘interest rate of 14%’ and ‘simple interest p.a.’. Learner C recorded an improvement of 29% to score 100% for questions related to making straightforward inferences in Question 3. This signalled that he now understood concepts such as ‘15% deposit’ and ‘value of deposit’ which are important to calculate the financial mathematics sums accurately. Learner C recorded an improvement of 25% in Question 4 of the post-test for

concepts related to making straightforward inferences. In the pre-test he did not understand concepts such as 'interest received each year'; however, by the end of the post-test he understood all four inference concepts in Question 4, which included 'interest rate of 8.5% per annum', 'simple interest' and 'total interest earned'.

The post-test results showed that Learner C understood questions related to retrieving explicitly stated information as he maintained a score of 100% in the post-tests. The post-test further revealed that he recorded an improvement in the questions that required him to make straightforward inferences, indicating that by using higher-order thinking skills, he now understood inference concepts such as 'deposits' and 'interest received each year'.

4.4.4. Learner D

Table 4.16 Learner D's post-test results

| Learner D – Post-test results | | | |
|--|--|--|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Interest Charged = A – P Interest Charged=R2040-R1500 Interest Charged = R540</p> <p>Correct calculation</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> | <p>- 10% deposit (20%) ✓ - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> | <p>$R5999 \times \frac{10}{100} = 599.9$ Total cost=R5999-10% Total cost=R5999-R599.9 Total cost=R5399.10</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> |

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| | | | |
|--|---|--|---|
| | Result: 100% | Result: 100% | Monthly Instalments = R7666,72 ÷ 36 Monthly Instalments = R212,96 Correct calculation |
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 Amount to borrow = R35000 - 15% Amount to borrow = R35000 - R5250 Amount to borrow = R29750</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29750(1 + \frac{13}{100} \times 3)$ $A = R41352,50$</p> <p>Monthly Instalments = R41352,50 ÷ 36 Monthly Instalments = R1148,68</p> <p>Correct calculation</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%) ✓</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = A - P Interest Earned = R35625 - R25000 Interest Earned = R10625</p> <p>4.4 $R10625 \div 5 = R2125$</p> <p>Correct calculation</p> |
| | Result: 100% | Result: 100% | |

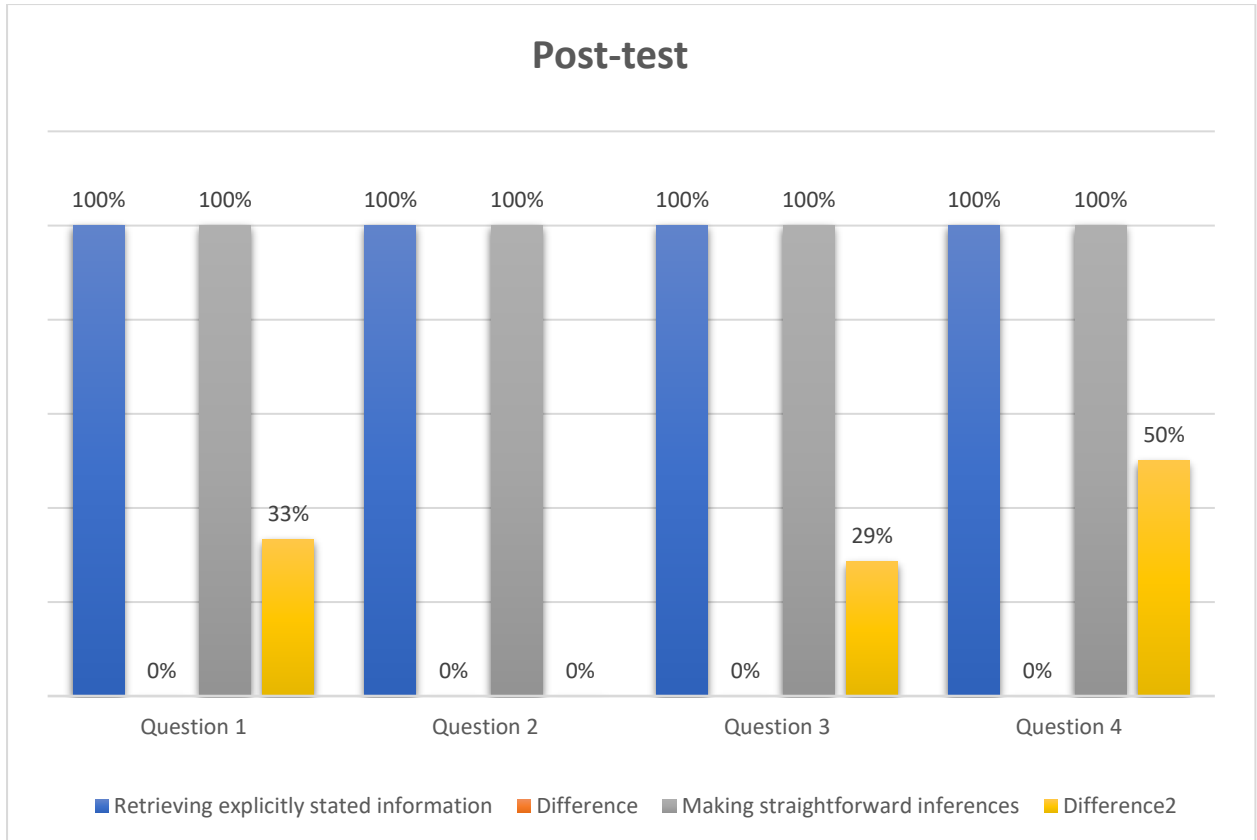


Figure 4.9 Summary of Learner D's post-test results

In the post-test, Learner D scored 100% on all four questions related to retrieving explicitly stated information. This indicated that he was able to find information that was explicitly presented, as this was important for him to make accurate substitutions into formulas when calculating financial mathematics word problem sums. His achievement in questions related to retrieving explicitly stated information formed the foundation for him to advance to higher-order thinking skills to enable him to understand what the questions implied.

For questions related to making straightforward inferences, the post-test results reveal that Learner D improved by 33% in Question 1 to attain a score of 100%. This indicates that he now understood concepts such as 'interest charged' that he did not comprehend in the pre-tests. In Question 2 of the post-test, he maintained a score of 100%. Learner D recorded an improvement of 29% for Question 3 to attain a perfect score. This signals that he understood concepts such as 'monthly instalment', 'borrows' and 'determine' whereas in the pre-test he did not understand these concepts. The pre-test revealed that Learner D did not understand half of the concepts related to making straightforward inferences for Question 4, yet in the post-test he understood all four inference concepts such as 'interest rate of 8.5% per annum', 'simple interest', 'total interest earned' and 'interest that Amanda received each year'. This indicates that Learner D could now utilise higher-order thinking skills such as analysing and evaluating.

The post-tests results revealed that Learner D was able to retrieve explicitly stated information, as he attained a score of 100% in all four questions in this category. The pre-test results revealed that he did not have a thorough understanding of questions related to making straightforward inferences, as he achieved a score of 100% in Question 2 but failed to attain the same score for Questions 1, 3 and 4. The post-test results indicate that Learner D improved by achieving a score of 100% in Questions 1, 3, and 4. The post-test results further indicate that as his performance increased in making straightforward inferences, the performance in the calculation of the financial mathematics word problem sums also increased.

4.4.5. Learner E

Table 4.17 Learner E's post-test results

| Learner E – Post-test results | | | |
|--|--|--|--|
| Questions | Retrieving explicitly stated information including mark weighting | Making straightforward inferences including mark weighting | Learner's calculation and researcher's comments |
| <p>The following mathematics concepts are linked to the two higher-order thinking skills:</p> <p>1. Find the interest charged on a loan of R1500 at 12% per annum for 3 years</p> | <p>-R1500 loan (50%) ✓ - 3 years (50%) ✓</p> <p>Result: 100%</p> | <p>-Find (33.3%) ✓ -interest charged (33.3%) ✓ -12% per annum (33.3%) ✓</p> <p>Result: 100%</p> | <p>$A = P(1 + i \times t)$ $A = R1500(1 + \frac{12}{100} \times 3)$ $A = R2040,00$</p> <p>Interest Charged = A – P Interest Charged=R2040-R1500 Interest Charged = R540</p> <p>Correct calculation</p> |
| <p>2. A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum which means per year). Find the monthly instalments</p> | <p>-R5999 computer (50%) ✓ - 3 years (50%) ✓</p> | <p>- 10% deposit (20%) ✓ - and the rest will be paid in equal monthly instalments (20%) ✓ - at an interest rate of 14% (20%) ✓ - Simple interest p.a. (20%) ✓ - Find the monthly instalments (20%) ✓</p> | <p>$R5999 \times \frac{10}{100} = 599,9$ Total cost=R5999-10% Total cost=R5999-R599,9 Total cost=R5399,10</p> <p>$A = P(1 + i \times t)$ $A = R5399,10(1 + \frac{14}{100} \times 3)$ $A = R7666,72$</p> |

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| | | | |
|--|--|--|--|
| | Result: 100% | Result: 100% | <p>Monthly Instalments = $R7666,72 \div 36$ Monthly Instalments = R212,96 Correct calculation</p> |
| <p>3. Claire buys furniture to the value of R35 000. She pays a 15% cash deposit, and signs a <u>hire purchase agreement</u> for the balance. The interest rate will be 13% per annum, and she will pay off the loan over a period of 3 years.</p> <p>3.1 What is the value of the deposit?</p> <p>3.2 Hence, determine the amount Claire borrows.</p> <p>3.3 What will the amount of her monthly instalment be?</p> | <p>-R35000 furniture (50%) ✓ - 3years (50%) ✓</p> | <p>-15% deposit (14.28%) ✓ -hire purchase (14.28%) ✓ - The interest rate will be 13% per annum (14.28%) ✓ -Value of deposit (14.28%) ✓ -Determine (14.28%) ✓ -borrows (14.28%) ✓ - monthly instalment (14.28%) ✓</p> | <p>3.1 $R35000 \times \frac{15}{100} = R5250$</p> <p>3.2 Amount to borrow = $R35000 - 15\%$ Amount to borrow = $R35000 - R5250$ Amount to borrow = R29750</p> <p>3.3 $A = P(1 + i \times t)$ $A = R29750(1 + \frac{13}{100} \times 3)$ $A = R41352,50$</p> <p>Monthly Instalments = $R41352,50 \div 36$ Monthly Instalments = R1148,68</p> <p>Correct calculation</p> |
| <p>4. The global Covid-19 pandemic has had severe impact on the economy. Amanda, doubtful of what the future entails, decides to invest R25000 in a savings account in order to save money. If the interest rate is 8.5% per annum simple interest, calculate:</p> <p>4.1 The total amount Amanda will have after 5 years.</p> <p>4.2 The total interest earned.</p> <p>4.3 The interest that Amanda received each year.</p> | <p>-R25000 savings (50%) ✓ -5 years (50%) ✓</p> | <p>- interest rate is 8.5% per annum (25%) ✓ -simple interest (25%) ✓ -total interest earned (25%) ✓ -The interest that Amanda received each year (25%) ✓</p> | <p>4.1 $A=P(1+ixt)$ $A = R25000(1 + \frac{18.5}{100} \times 5)$ $A = R35625$</p> <p>4.2 Interest Earned = $A - P$ Interest Earned = $R35625 - R25000$ Interest Earned = R10625</p> <p>4.5 $R10625 \div 5 = R2125$</p> <p>Correct calculation</p> |
| | Result: 100% | Result: 100% | |

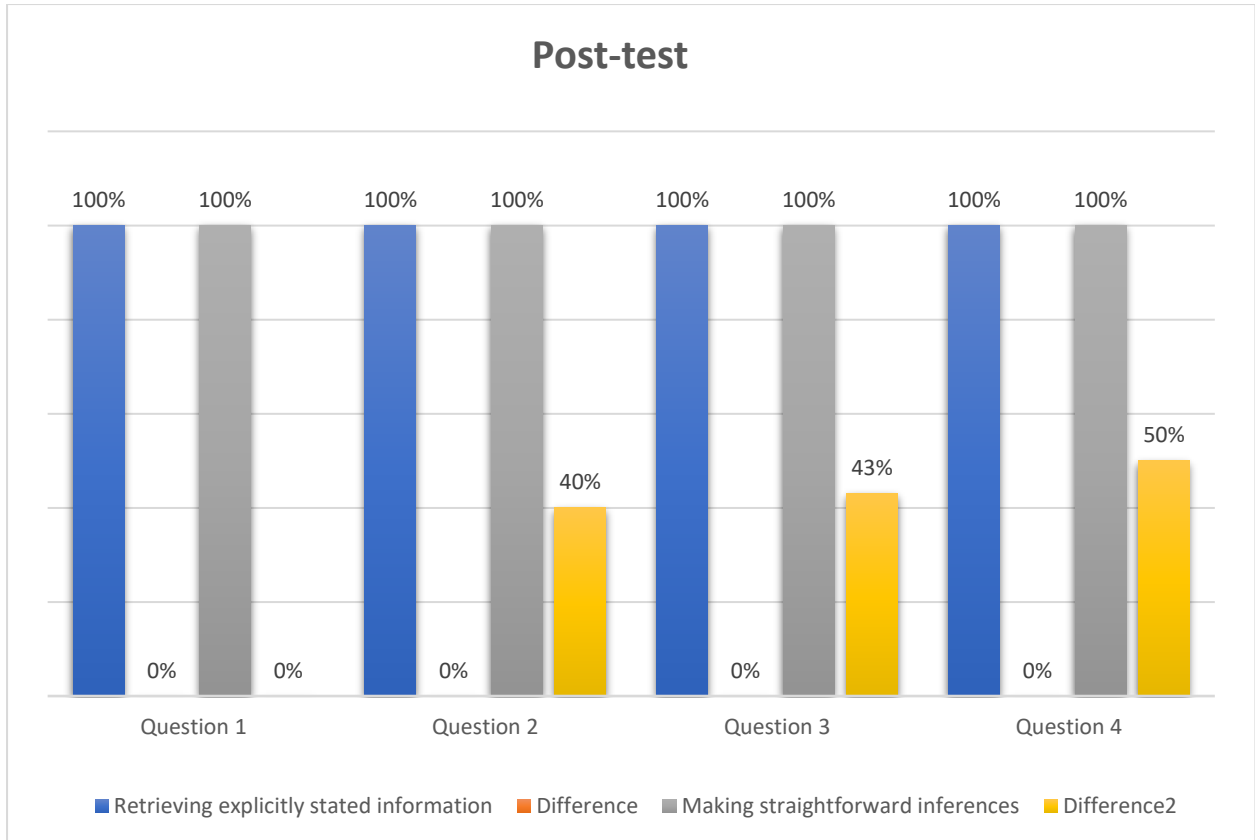


Figure 4.10 Summary of Learner E’s post-test results

The post-test results reveal that Learner E was able to maintain a performance of 100% in Questions 1 to 4 for retrieving explicitly stated information. This was important as it laid the basis for him to progress through lower-order to higher-order thinking skills. His ability to retrieve explicitly stated information was central to building his knowledge of word meaning and ability to accurately calculate financial mathematics word problem sums.

According to the post-test results, Learner E maintained a score of 100% in Question 1 for making straightforward inferences. This indicates that he understood concepts such as ‘find’, ‘interest charged’ and ‘12% per annum’. In Question 2, he improved by 40% in relation to making straightforward inferences. While in the pre-test he did not understand concepts such as ‘equal monthly instalments’, by the end of the IP in the post-test he understood all five inference concepts of this question and made the correct calculations. This indicates that Learner E was able to display thinking skills such as understanding, application and analysis. In Question 3, the pre-test results revealed that Learner E understood only 57% of the concepts that required him to make straightforward inferences. By the end of the post-test, Learner E improved by 43% in understanding the seven inference concepts in this question. This indicates that he now understood concepts such as ‘determine’, ‘borrows’ and ‘monthly instalments’ that he got wrong in the pre-test. For Question 4, the pre-test results showed that Learner E did not understand half of the concepts related to making straightforward inferences.

However, the post-test results reveal that he now understood all four inference concepts, such as 'total interest earned' and 'interest received each year' that he got wrong in the pre-test. This indicates that he could apply higher-order thinking skills such as evaluating and creating.

The post-test results reveal that Learner E was able to maintain a performance of 100% for questions that required him to retrieve explicitly stated information. This was important, as it laid the foundation for him to accurately answer the financial mathematics word problem sums. The pre-test results showed that except for Question 1, Learner E struggled to make straightforward inferences, as he failed to score more than 60% for Questions 2, 3 and 4. The post-test results showed an improvement in Learner E's ability to retrieve explicitly stated information, as he scored 100% in all four questions. The post-test results further indicate that as his performance increased in making straightforward inferences and using higher-order thinking skills, his performance in the calculation of the financial mathematics word problem sums also increased.

4.5. Chapter summary

Chapter 4 of the study presents and discusses the analysed data related to the main research question and three sub-questions. Significant findings were made and are based on the qualitative data which emerged from the pre- and post-test results, the IP, learners' reflections, teachers' interviews, as well as the observations of five Grade 10 learners.

Research sub-question 1 focuses on the learners' understanding of inference skills prior to the IP. A pre-test was conducted to assess their comprehension skills in retrieving explicitly stated information and making straightforward inferences. While the learners performed well in retrieving explicitly stated information, scoring 100%, their performance in making straightforward inferences was weaker, with an average score of 57.45%. The financial mathematics concepts that emerged as least understood by the learners included interest charged, deposits, total interest earned, and borrows. This indicated a lack of understanding in this specific comprehension skill, as well as difficulties in accurately calculating solutions to financial mathematics word problems.

Research Question 2 examines the cognitive development of the learners during the IP. The learners demonstrated progress in understanding and calculating financial mathematics content, transitioning from Bloom's taxonomies lower-order to higher-order thinking skills. They actively engaged in comprehension activities such as My turn-your turn, Anticipation guides, Think aloud, and Feature matrix. They also began sharing their opinions and understandings with the rest of the class, thereby creating a community of practice. The presence of a more knowledgeable other and the learning community scaffolded the learners'

understanding of Grade 10 Financial Mathematics concepts and facilitated the learners higher-order cognitive development.

In terms of cognitive development, at the beginning of the IP, the five learners displayed an understanding of lower-order thinking skills such as remembering, understanding, and application. During the IP, the achievement of higher-order thinking skills varied among the learners, with clear examples of analysis and evaluation observed. Learners' A and B demonstrated the cognitive level of creating and exhibited a higher level of understanding, explaining and analysing concepts independently. All five learners progressed from lower-order to higher-order thinking skills during the IP.

Research Question 3 focuses on the post-test results. The findings indicated improvement in all five learners' ability to retrieve explicitly stated information, with a perfect score in all questions. Their performance in making straightforward inferences and using higher-order thinking skills showed an increase of 41.72%. This indicates a positive development in their ability to solve problem sums in Grade 10 Financial Mathematics.

In summary, the findings suggest that the 8-week teaching phase of the IP had a positive impact on the learners' understanding of inference skills, cognitive development, and performance in Grade 10 Financial Mathematics. The learners showed progress in both comprehension skills and higher-order thinking abilities, benefiting from the instructional strategies and the supportive learning community created during the intervention.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This chapter engages in a comprehensive discussion of the most significant findings of the study and their implications. The focus of this study is on addressing the learners' understandings of inference-comprehension skills, exploring the impact of the community of practice (CoP), examining the application of Bloom's taxonomy, and assessing the effectiveness of the IP within the Grade 10 Financial Mathematics curriculum. Subsequently, recommendations are provided for teaching comprehension skills in Grade 10 Financial Mathematics, suggestions for policy development ideas and for further research. Finally, conclusions are drawn based on the study's findings.

5.2. Discussion

The key findings of the study and their ramifications are discussed in this section, grounded in the research questions that have guided this inquiry. These questions are centred on the impact of teaching inference skills in Grade 10 Financial Mathematics during a ten-week IP, the learners' understanding of inference skills before and after the IP, and the development of their cognitive abilities during the IP. To elaborate on these findings, the discussion is divided into four key outcomes of this study:

1. Learners' understanding of inference-comprehension skills
2. Impact of the COP
3. Bloom's taxonomy
4. Intervention Programme (IP) effectiveness

5.2.1. Learners' understanding of inference-comprehension skills

One of the most significant findings of this study has been the learners' understanding of inference-comprehension skills. A pivotal finding of this research has been the substantial impact of learners' proficiency in inference-making on their ability to solve word problems in financial mathematics. The notable gains observed in learners' inference-comprehension skills, particularly in the context of solving word problems in financial mathematics, were somewhat unexpected given the initial challenges identified and the learners' potential for improvement.

As illuminated in Chapters 2 and 4, learners frequently encountered greater challenges when confronted with word problems compared to straightforward computational tasks. The primary

reason for this heightened difficulty lay in the learners' struggles with both comprehending the textual content and making inferences within word problems. This was corroborated by Teacher X, who expressed that the learners struggled to grasp the meaning of the words. Consequently, learners experienced difficulty in discerning the specific requirements of the problems they were attempting to solve. This finding accentuates the critical role that reading comprehension and inference-making play in the successful resolution of financial mathematics word problems.

The study identified a significant deficiency in learners' inference-comprehension skills before the IP. While they excelled in retrieving explicitly stated information, they struggled with making straightforward inferences, as evidenced by notable gaps in pre-test scores. This lack of inference proficiency directly hampered their ability to solve Grade 10 Financial Mathematics word problems, where interpreting and inferring information is crucial.

During the teaching phase of the IP, the primary goal was to equip the five Grade 10 learners with enhanced reading comprehension skills, specifically tailored to improve their ability to understand and solve financial mathematics problems. The learners displayed a commendable progression in cognitive development during the IP, transitioning from lower-order to higher-order thinking skills. The implementation of various comprehension strategies, such as My turn-your turn, Anticipation guides, Think aloud, and Feature matrix, contributed significantly to this advancement. Notably, the learners actively participated in comprehension activities in the IP, sharing their opinions and understandings, thereby fostering a COP. This social learning environment played a crucial role in shaping their inferential thinking skills.

After the teaching phase of the IP, the post-test results underscored the positive impact of the IP on learners' inference-comprehension skills. The improvement in their ability to make straightforward inferences and employ higher-order thinking skills, with a notable increase of 41.72%, indicated the effectiveness of the intervention in enhancing their problem-solving capabilities in Grade 10 Financial Mathematics. The findings in this regard underscored the need for targeted interventions and teaching strategies to improve learners' inferential thinking skills. Fostering their ability to bridge the gap between explicit information and inferred insights is essential for enhancing their problem-solving capabilities in financial mathematics, which is a fundamental objective of the study.

5.2.2. Impact of the COP

This study explains the central importance of the COP within the context of teaching inference skills in Grade 10 Financial Mathematics. Leveraging Wenger's social theory of learning, the research considered the classroom as a CoP where learners actively participated in financial mathematics and comprehension activities. The CoP, as a social learning process, enabled

learners to share perspectives, fostering an environment conducive to collaborative learning and knowledge enhancement.

The CoP created during the IP played a pivotal role in the cognitive development of the five Grade 10 learners. Throughout the eight-week teaching phase of the IP, these learners progressed from lower-order to higher-order thinking skills, influenced by the comprehension strategies and various levels of questions asked of the tasks during the IP classes. Importantly, as they engaged in comprehension activities in the class, the learners not only shared their opinions and understandings in this safe space, but also began to learn from each other, giving rise to an effective CoP.

The CoP facilitated collaborative learning, allowing learners to share knowledge, skills, experiences, and ideas. This social learning process enhanced their understanding of financial mathematics, aligning with Vygotsky's principles of scaffolding. The presence of a More Knowledgeable Other (represented by the researcher), contributed to scaffolding the learners' understanding through the teaching of comprehension strategies.

The social nature of the CoP provided a platform for learners to engage in meaningful interactions, fostering an environment where they could collectively increase their knowledge and critical thinking skills. This social learning process facilitated knowledge sharing and collaboration, contributing to the learners' overall progress in both comprehension skills and higher-order thinking abilities. These findings underscore the importance of the CoP in the context of teaching inference skills and its positive impact on learners' engagement and development in Grade 10 Financial Mathematics.

5.2.3. Bloom's taxonomy

A second major finding in this study arose from the use of Bloom's taxonomy in assessing and enhancing the cognitive development of Grade 10 Financial Mathematics learners who participated in the IP. The taxonomy, which categorises cognitive processes into six levels ranging from lower-order to higher-order thinking skills, provided a structured framework to evaluate learners' progress, comprehension skills, and higher-order thinking abilities during the ten-week intervention.

The integration of Bloom's taxonomy into the eight-week teaching phase of the IP facilitated a comprehensive analysis of learners' cognitive development. The study designed lessons that required learners not only to remember and understand concepts but also to apply, analyse, evaluate, and even create solutions to complex financial mathematics problems. This approach aligned with the study's objective of enhancing learners' comprehension and cognitive skills.

Throughout the IP, Bloom's taxonomy served as a critical tool to categorise and evaluate the learners' cognitive growth. The study tracked their progression from lower-order thinking, involving the recall of facts and understanding of concepts, to higher-order thinking, such as analysing and evaluating complex financial mathematics problems. The taxonomy's structured approach enabled the researcher to assess the learners' cognitive development systematically. The findings demonstrated that, despite variations in achieving higher-order thinking skills among learners, the majority showed clear examples of analysis, and some even achieved the cognitive level of creating.

Participant observations during the IP further contributed to the assessment of cognitive development. The researcher closely observed the learners' behaviour and engagement, tracking their progression from lower-order to higher-order thinking skills according to Bloom's taxonomy. Direct quotations from learners were incorporated into tables, providing concrete examples of their cognitive development across different levels of the taxonomy. The analysis of cognitive verbs used by learners in their responses provided additional evidence of their cognitive growth.

The results of this study indicate that the conceptual framework, integrating Bloom's taxonomy with Vygotsky's theory of social constructivism and Wenger's social theory of learning, provided a comprehensive lens for examining how social interaction, collaborative learning, and cognitive development occurred within the context of teaching inference skills in Grade 10 Financial Mathematics during the intervention. The findings highlighted the significant impact of Bloom's taxonomy in guiding the assessment of learners' cognitive growth and skill development throughout the study.

5.2.4. Intervention Programme (IP)

Central to this thesis was the IP. It was carefully designed and implemented, focussing on equipping the five Grade 10 learners with enhanced reading comprehension skills, particularly in the context of financial mathematics. The primary goal of the research was to evaluate each learner's grasp of inference skills before, during, and after the IP. The objectives of the IP were to introduce comprehension strategies, enhance cognitive development, and motivate learners who had struggled academically, with a focus on encouraging critical thinking and improving higher-order thinking abilities.

Pre- and post-tests played a crucial role in assessing learners' comprehension skills and the impact of the IP. The pre-test provided a baseline for the learners' financial mathematics problem-solving abilities and identified areas for improvement. The findings shaped the content and direction of the teaching phase, ensuring a targeted approach to addressing learners' needs.

The IP spanned ten weeks, with the teaching phase dedicated to equipping learners with comprehension strategies and financial mathematics content. The selection of strategies such as My turn-your turn, Think aloud, Anticipation guides, and the Feature matrix aimed to create an interactive and engaging learning atmosphere. The structured alignment between content and strategies acted as scaffolding, transitioning learners from reliance on external assistance to independent learning.

Throughout the IP, learners demonstrated cognitive development, progressing from lower-order to higher-order thinking skills. The use of Bloom's taxonomy provided a framework for analysing their cognitive growth. The learners actively engaged with comprehension strategies, shared their understandings, and formed a CoP. The CoP, influenced by Vygotsky's principles, played a significant role in scaffolding learners' understanding of financial mathematics concepts. The creation of a CoP emerged as a significant factor in the learners' cognitive development. Social interactions within the CoP facilitated knowledge sharing and scaffolded their understanding of financial mathematics concepts.

The IP had a positive impact on learners' understanding of inference skills, cognitive development, and performance in Grade 10 Financial Mathematics. The combination of carefully selected comprehension strategies, alignment with Bloom's taxonomy, and the creation of a supportive CoP contributed to the success of the intervention. The findings underscored the effectiveness of targeted interventions in enhancing learners' comprehension skills and higher-order thinking abilities in the context of financial mathematics.

5.3. Recommendations

This study assessed the effectiveness of a ten-week IP on enhancing Grade 10 learners' inference skills, cognitive development, and performance in financial mathematics, utilising comprehension strategies, Bloom's taxonomy, and establishing a CoP. The following section outlines the proposed recommendations.

5.3.1. Recommendations for teaching comprehension skills in Grade 10 Financial Mathematics

It is recommended that:

- Mathematics teachers should integrate comprehension strategies such as My turn-your turn, Anticipation guides, Think aloud, and Feature matrix within their financial mathematics classes. These strategies have shown effectiveness in fostering inferential thinking skills and bridging the gap between explicit and inferred information.
- Mathematics teachers should emphasise the contextual application of comprehension skills within financial mathematics word problems, by developing teaching materials

and exercises that reflect real-world scenarios, encouraging learners to apply inference skills in practical problem-solving contexts.

- Mathematics teachers should implement regular assessments focusing on inference-making skills, including both formative and summative evaluations. These assessments should gauge learners' ability to make inferences within the context of financial mathematics.
- Teachers should foster collaborative learning environments where learners share opinions, understandings, and insights. Establishing a CoP, as observed during the IP, can create a supportive and safe space for learners to enhance their comprehension skills through social interactions.
- Higher Education Institutions (HEIs) should provide student teachers with professional development opportunities to enhance their understanding and incorporation of comprehension strategies within financial mathematics. This can contribute to creating more effective and engaging learning experiences for learners.

5.3.2. Recommendations for policy development

It is recommended that:

- The DBE should explicitly include inference-comprehension skills within the official curriculum standards for Grade 10 Financial Mathematics. This integration should emphasise the importance of these skills for holistic mathematical problem-solving.
- HEIs and the DBE should allocate resources for the development and distribution of teaching materials, textbooks, and other resources that specifically address the enhancement of inference-making skills in financial mathematics. Ensuring the availability of such resources would support both teachers and learners in achieving better outcomes.
- HEIs should integrate training in effective teaching strategies for inference skills within financial mathematics into pre-service and in-service teacher training programmes.

5.3.3. Recommendations for further research

It is recommended that:

- Large-scale research be conducted by current master's and doctoral students focussing on the impact of inference skill interventions on learners' performance in financial mathematics in both the FET and GET phases.
- Alternative teaching strategies and interventions be explored beyond those employed in the current study. Comparative research on diverse approaches can contribute to a more comprehensive understanding of effective methods for enhancing inference skills.

5.4. Conclusion

This study explored the intricate landscape of Grade 10 Financial Mathematics, with a particular focus on learners' understanding of inference-comprehension skills. Through the ten-week IP, enriched with comprehension strategies, Bloom's taxonomy, Vygotsky's theories and the establishment of a CoP, the research aimed to unravel the impact of these elements on learners' cognitive development and problem-solving abilities. As the study draws conclusions from the findings, it is evident that several critical aspects have come to light.

Foremost, the study highlighted the profound influence of learners' proficiency in inference-making on their adeptness at solving word problems in financial mathematics. The struggles observed in comprehending textual content and making inferences within word problems underscored the important role of reading comprehension and inference-making in surmounting challenges in financial mathematics.

The deficiency identified in learners' inference-comprehension skills before the IP accentuates the urgency for targeted interventions. Despite their commendable ability to retrieve explicitly stated information, the struggle with making straightforward inferences significantly hindered their capacity to solve complex financial mathematics problems. The IP's teaching phase emerged as a transformative period, witnessing a noteworthy progression in learners' cognitive development – a journey from lower-order to higher-order thinking skills.

The creation of a CoP emerged as a cornerstone in this transformative journey. The CoP, cultivated through social interactions and knowledge sharing, played a pivotal role in scaffolding learners' understanding of financial mathematics concepts. Vygotsky's principles of social constructivism came to life as the learners actively engaged in comprehension activities, sharing perspectives, and collectively progressing in their comprehension skills.

Bloom's taxonomy served as an invaluable analytical tool, structuring the assessment of learners' cognitive growth. The taxonomy's tiered levels provided a comprehensive framework for evaluating the learners' progression from basic understanding to the application, analysis, and creation of solutions to intricate financial mathematics problems. The structured alignment of comprehension strategies with Bloom's taxonomy facilitated a systematic analysis of learners' cognitive development during the IP.

The IP emerged as a beacon of success, effectively enhancing learners' inference skills, cognitive development, and performance in Grade 10 Financial Mathematics. The careful integration of comprehension strategies, alignment with Bloom's taxonomy, and the creation of a supportive CoP collectively contributed to this positive impact. The post-test results, indicating a substantial increase in learners' ability to make inferences and employ higher-order thinking skills, provided empirical evidence of the IP's success.

This study contributes valuable insights into the multifaceted landscape of teaching and learning inference skills in Grade 10 Financial Mathematics. The study not only unravelled the intricacies of learners' challenges in financial mathematics but also illuminated a path forward. The recommendations outlined for teaching comprehension skills, policy development, and further research aimed to shape the discourse and actions in the realm of Grade 10 Financial Mathematics education. As the research study concludes, the narrative pivots towards a future where targeted interventions, collaborative learning environments, and strategic policy decisions converge to enrich the educational landscape and empower learners to navigate the complexities of financial mathematics with confidence and proficiency.

Three key conclusions arise from this research.

Firstly, the IP led to enhanced critical thinking abilities among the five learners, as evidenced in Chapter 4. The learners demonstrated improved performance in making straightforward inferences and solving financial mathematics problems.

Secondly, by integrating elements from Vygotsky's (1978), Bloom's (2001), and Wenger's (2005) theories, the research established a robust platform that elevated learners from lower to higher-order critical thinking. Social integration and constructive collaboration during activities facilitated cognitive development and confidence growth.

Thirdly, the simple yet engaging activities and pedagogical approaches employed in this study, lacking guidance in governmental curricular documents, highlight the need for these strategies to be incorporated into compulsory teacher training courses at HEIs across all levels and subjects.

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APPENDIX 1: INDIVIDUAL INTERVIEW SCHEDULE FOR PREVIOUS FINANCIAL MATHEMATICES TEACHERS IN GRADE 8 AND 9

Name of Participant:

Date:

Venue:

| MAIN QUESTION | POSSIBLE PROBING QUESTIONS | REASON FOR THE QUESTION | BODY LANGUAGE |
|--|---|---|---------------|
| How would you describe the learner's overall performance in your Mathematics previous classes? | <ul style="list-style-type: none"> • What is the level of achievement of the learner in this subject? • What Mathematics concepts does the learner understand or not understand – can you explain your answer | Assessment of general performance of the learner in the Mathematics class | |
| What have been some of your good / or challenging experiences teaching Financial Mathematics? Please explain | <ul style="list-style-type: none"> • Comment on some of your good / or challenging experiences teaching Financial Mathematics? | To get feedback of the teacher's experiences teaching the subject | |
| How would you describe the learner's ability to link the questions to the text? | How well does the learner link questions asked to the given text? | To understand the learner's ability to draw inference | |
| How would you describe the learners understanding of inference skills in your Maths lessons? | <ul style="list-style-type: none"> • Is the learner able to understand inferences from texts in Financial Mathematics | To deduce if the learner is able to draw straight-forward inference, local inference, global inferences, etc., in the problem sums. | |

| | | | |
|---|--|---|--|
| | problem sums? | | |
| How would you describe the learner's ability to link the questions to the correct formula? | <ul style="list-style-type: none"> Is the learner able to link the question to the correct formula? | To understand the depth of the learners Financial Mathematics skills. | |
| Please comment on the learner's algebraic skills? | <ul style="list-style-type: none"> Is the learner able to do algebraic calculations well/or is additional support needed? Please explain why? | To understand the level of algebraic skills of the learner | |
| To what extent does your teaching include the different levels of Bloom's taxonomy? | <ul style="list-style-type: none"> How do you include or refer to Bloom's taxonomy during your lessons? | To understand how the learners move from low-order understanding to higher-order understanding of problem sums. | |
| Is there anything else that you think would be helpful for me to know in teaching your learners Financial Mathematics and inference skills? | <ul style="list-style-type: none"> Is there anything you'd like to share with me, that you think is important for me to know | To get useful information that might have not been captured | |

APPENDIX 2: INDIVIDUAL INTERVIEW SCHEDULE FOR GRADE 10 LEARNERS

Name of Participant:

Date:

Venue:

| MAIN QUESTION | POSSIBLE PROBING QUESTIONS | REASON FOR THE QUESTION | BODY LANGUAGE |
|--|---|--|---------------|
| How would you describe your overall experience with Financial Mathematics? | <ul style="list-style-type: none"> • What is your perception of your performance in Financial Mathematics? • Can you tell me about your experiences with Financial Mathematics classes. | <p>To assess the learners' self-perception of their performance in the subject.</p> <p>To understand the learners' overall experiences with the subject.</p> | |
| How do you approach word problem sums in Financial Mathematics? | <ul style="list-style-type: none"> • When you see a word problem sum, what is your initial approach to solving it? • Can you describe the strategies or methods you use to understand and solve word problems in Financial Mathematics? | <p>To gain insight into the learners' problem-solving techniques.</p> <p>To understand how learners approach problem-solving in Financial Mathematics.</p> | |
| How confident do you feel in linking questions to the text in Financial Mathematics word problems? | <ul style="list-style-type: none"> • Do you feel confident in linking the questions asked to the text provided in Financial Mathematics word problems? | <p>To assess the learners' confidence in drawing inferences from textual information.</p> | |
| How confident are you in linking questions to the correct formula in Financial Mathematics? | <ul style="list-style-type: none"> • Do you feel confident in connecting the questions to the appropriate formulas in | <p>To assess the learners' confidence in applying mathematical formulas.</p> | |

| | Financial Mathematics? | | |
|--|--|--|--|
| How would you describe your algebraic skills in Financial Mathematics? | <ul style="list-style-type: none"> • Would you say you are proficient in algebraic calculations in Financial Mathematics, or do you feel you need additional support? | To understand the learners' self-assessment of their algebraic skills and whether they feel they need extra help | |
| Is there anything else you would like to share about your experience with Financial Mathematics and your learning needs? | <ul style="list-style-type: none"> • Is there anything else you'd like to tell me that you think is important for me to know? | To provide learners with an opportunity to share any additional insights or concerns related to the study. | |

APPENDIX 3: OBSERVATION SCHEDULE

| Date: | | Lesson number: |
|--|--|-----------------------|
| Concepts observed | | Reflections |
| Simple interest | | |
| Exchange rates | | |
| Taxation (VAT) | | |
| Compound interest | | |
| Discount | | |
| Timeline | | |
| Salary Increase | | |
| Profit and Loss | | |
| Use of inferences: straightforward inference, local inference, global inferences or any other inference skill | | |
| How did the learners solve their mathematical problem activities? | | |
| What levels of higher-order thinking skills (Bloom's taxonomy) were apparent during this lesson? | | |
| How have the learners socially participated during this lesson? | | |
| How motivated are the learners during this lesson? How does this show? Were they intrinsically or extrinsically motivated – why do I say this? | | |
| How has this lesson linked to my theoretical framework and what are the implications? | | |
| Other important observations | | |

APPENDIX 4: PRE-TEST DRAFT

| Question Number | Before Piloting |
|------------------------|--|
| 1 | Calculate the accrued amount (total) when a principal of $P = R1500$ is invested at an annual interest rate of 12% for a period of 3 years. |
| 2 | A computer costs R5999. Calculate the 10% deposit required. The remaining amount will be paid through equal monthly instalments over a three-year period at a simple interest rate of 14% per annum. Determine the value of each monthly instalment. |
| 3.1 | Determine the cash deposit made by John. |
| 3.2 | Calculate the principal amount John borrows. |
| 3.3 | Find the monthly instalment required to repay the loan. |
| 4.1 | The total accumulated amount Sarah will possess after 5 years. |
| 4.2 | Determine the annual interest received by Sarah. |
| 4.3 | Compute the overall interest earned over the given period. |

APPENDIX 5: REVISED PRE-TEST

| Question Number | Question |
|-----------------|--|
| 1 | Find the interest charged on a loan of R1500 at 12% per annum (p.a.) for 3 years. |
| 2 | A computer costs R5999. The shop requires a 10% deposit and the rest will be paid in equal monthly instalments over a three-year period at an interest rate of 14% simple interest p.a. (per annum, which means per year). Find the monthly instalments. |
| 3.1 | What is the value of the deposit? |
| 3.2 | Hence, determine the amount Claire borrows. |
| 3.3 | What will the amount of her monthly instalment be? |
| 4.1 | The total amount Amanda will have after 5 years. |
| 4.2 | The interest that Amanda received each year. |
| 4.3 | The total interest earned. |

APPENDIX 6: CPUT ETHICAL CLEARANCE



Private Bag X8, Wellington, 7654
Jan van Riebeeck Street, Wellington, 7654
Tel: +27 21 864 5200

P.O. Box 652, Cape Town, 8000
Highbury Road, Mowbray
Tel: +27 21 680 1500

| |
|-----------------------------|
| FACULTY OF EDUCATION |
|-----------------------------|

On the **10/09/2020** the Chairperson of the Education Ethics Committee of the Cape Peninsula University of Technology granted ethics approval **EFEC 13-9/2020** to **S Thwala** for research activities related to the staff project at the Cape Peninsula University of Technology.

| | |
|-------------------------|---|
| Title of thesis: | The impact of teaching inference skills on the comprehension of word-problem sums in Grade 10 Financial Mathematics |
|-------------------------|---|

Comments:

Permission is granted to conduct research within the Faculty of Education only. Research activities are restricted to those details in the research project.

A handwritten signature in black ink, appearing to read "Livingston".

Date: 10 September 2020

Dr Candice Livingston

Research coordinator (Wellington) and Chair of the Education Faculty Ethics Committee

Faculty of Education

APPENDIX 7: WCED APPROVAL



Directorate: Research

Audrey.wyngaard@westerncape.gov.za

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

wced.wcape.gov.za

REFERENCE: 20200930-8349

ENQUIRIES: Dr A T Wyngaard

Mr Sibusiso Thwala
10 Upper Darling Street
Zonnebloem
Cape Town
8001

Dear Mr Sibusiso Thwala

RESEARCH PROPOSAL: THE IMPACT OF TEACHING INFERENCE SKILLS ON THE COMPREHENSION OF WORD-PROBLEM SUMS IN GRADE 10 FINANCIAL MATHEMATICS

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **26 January 2021 till 30 June 2021**.
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

**The Director: Research Services
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000**

We wish you success in your research.

Kind regards.

Signed: Dr Audrey T Wyngaard

Directorate: Research

DATE: 30 September 2020

Lower Parliament Street, Cape Town, 8001
tel: +27 21 467 9272 fax: 0865902282
Safe Schools: 0800 45 46 47

Private Bag X9114, Cape Town, 8000
Employment and salary enquiries: 0861 92 33 22
www.westerncape.gov.za

APPENDIX 8: PRINCIPAL APPROVAL

APPENDIX D: LETTER OF REQUEST OF PARTICIPATION OF SCHOOL PRINCIPAL AND TEACHERS

Faculty of Education
Ethics informed consent form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

| | | | | | | | | | |
|------------------------|---|-----------------|--|----------------|--|------------------|--|-----------------|--|
| <i>Principals</i> | X | <i>Teachers</i> | | <i>Parents</i> | | <i>Lecturers</i> | | <i>Students</i> | |
| <i>Other (specify)</i> | | | | | | | | | |

You are kindly invited to participate in a research study being conducted by SIBUSISO EMMANUEL THWALA from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

| | | | |
|----------------------------------|---|------------------------------------|--|
| <i>An undergraduate project</i> | | <i>A conference paper</i> | |
| <i>An Honours project</i> | | <i>A published journal article</i> | |
| <i>A Masters/doctoral thesis</i> | X | <i>A published report</i> | |

15 December 2020

Dear [REDACTED]

Request permission to work with your learners for my CPUT Master's research project

I am currently affiliated with Cape Peninsula University of Technology where I am doing my Master's degree in Education. My research topic is: "Teaching inference to a group of five Grade 10 learners, to understand Financial Mathematics."


I would like to obtain your permission to work with five Grade 10 learners and observe them at a time that is convenient during school hours – particularly in the afternoon. In addition I would like your permission to approach the learner's current/past educator to conduct an interview during the proposed period. My role will be to observe the learner's higher-order thinking skills (particularly inference skills) in the Financial Mathematics classroom and work with the learners through an Intervention Programme with the aim of improving their inference and Financial Mathematics skills. I will not in any way disrupt their other learning processes.

I will require you and the educator, to sign this letter of consent form which gives me your permission to continue with this research. My research plan is to work with and observe the five Grade 10 learners from 1 February 2021 till 26 March 2021. This gives me 8 weeks where I will work closely with these learners twice a week for 30 minutes.

All the information obtained from my work will be kept strictly confidential and that the above arrangement can be terminated at any time. The research project, when completed, will be available for you to view. Please note that no where will you, the teachers or any of the learner's identity be revealed. Please feel free to contact me if you need any additional information regarding this research proposal.

Yours sincerely

Mr S E Thwala

I Mr/Mrs  (Principal) give permission to Mr S E Thwala to work with five Grade 10 learners of our school and to interview the previous educator(s) of the five Grade 10 learners for your CPUT Masters research project.

Signature.....



Date:.....



APPENDIX 9: TEACHER CONSENT FORM



APPENDIX D: LETTER OF REQUEST OF PARTICIPATION TEACHERS

**Faculty of Education
Ethics informed consent form**

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

| | | | | | | | | | |
|------------------------|--------------------------|-----------------|-------------------------------------|----------------|--------------------------|------------------|--------------------------|-----------------|--------------------------|
| <i>Principals</i> | <input type="checkbox"/> | <i>Teachers</i> | <input checked="" type="checkbox"/> | <i>Parents</i> | <input type="checkbox"/> | <i>Lecturers</i> | <input type="checkbox"/> | <i>Students</i> | <input type="checkbox"/> |
| <i>Other (specify)</i> | | | | | | | | | |

You are kindly invited to participate in a research study being conducted by SIBUSISO EMMANUEL THWALA from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

| | | | |
|----------------------------------|-------------------------------------|------------------------------------|--------------------------|
| <i>An undergraduate project</i> | <input type="checkbox"/> | <i>A conference paper</i> | <input type="checkbox"/> |
| <i>An Honours project</i> | <input type="checkbox"/> | <i>A published journal article</i> | <input type="checkbox"/> |
| <i>A Masters/doctoral thesis</i> | <input checked="" type="checkbox"/> | <i>A published report</i> | <input type="checkbox"/> |

19 February 2021

Dear [REDACTED]

Request permission to interview you for my CPUT Master's research project

I am currently affiliated with Cape Peninsula University of Technology where I am doing my Master's degree in Education. My research topic is: "The impact of teaching inference skills on the comprehension of word-problem sums in Grade 10 Financial Mathematics."

I would like to obtain your permission to interview you with regards to the subject (Mathematics) at your school as well as your experience in working with some of the learners I will be working with in a ten work programme.

I will require you to sign this letter of consent form which gives me your permission to interview you. My research plan is to work with and observe five Grade 10 learners from 15 February 2021 till 23 April 2021. This gives me 10 weeks where I will work closely with these learners twice a week for 30 minutes.

All the information obtained from my work will be kept strictly confidential and the above arrangement can be terminated at any time. The research project, when completed, will be available for you to view. Please note that no where will you or any of the learner's identity be revealed. Please feel free to contact me if you need any additional information regarding this research proposal.

Yours sincerely

Mr S E Thwala

I Mr/Mrs [REDACTED] (Teacher) give permission to Mr S E Thwala to interview me for his CPUT Masters research project.

Signature: [REDACTED] Date: [REDACTED]

APPENDIX 10: PARENT CONSENT FORM



APPENDIX E : LETTER OF REQUEST FOR PARTICIPATION OF LEARNERS FROM PARENTS/GUARDIANS

**Faculty of Education
Ethics informed consent form**

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

| | | | | | | | | | |
|------------------------|--|-----------------|--|----------------|---|------------------|--|-----------------|--|
| <i>Principals</i> | | <i>Teachers</i> | | <i>Parents</i> | X | <i>Lecturers</i> | | <i>Students</i> | |
| <i>Other (specify)</i> | | | | | | | | | |

You are kindly invited to participate in a research study being conducted by SIBUSISO EMMANUEL THWALA from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

| | | | |
|----------------------------------|---|------------------------------------|--|
| <i>An undergraduate project</i> | | <i>A conference paper</i> | |
| <i>An Honours project</i> | | <i>A published journal article</i> | |
| <i>A Masters/doctoral thesis</i> | X | <i>A published report</i> | |

Date: 15 February 2021

Dear Parent/Guardian

Request permission to work with your child for my CPUT Masters research project

I am currently affiliated with Cape Peninsula University of Technology where I am doing my Master of Education degree specializing in Inclusive Education. My research topic is:

“The impact of teaching inference skills on the comprehension of word-problem sums in Grade 10 Financial Mathematics”.

I would like to obtain your permission to work with your child at a time that is

convenient for your child during school hours (Afternoon). My role will be to work with your child in relation to comprehension strategies in the classroom with purposes of improving their performance in Financial Mathematics. I will not in any way disrupt his/her other learning processes.

I will require you, to sign this letter of consent form which gives me your permission to continue with this research. My research plan is to work with your child for the first term. This gives me 8 weeks where I will work closely with your child for 30 minutes two days a week.

All the information obtained from my research will be kept strictly confidential and that the above arrangement can be terminated at any time. The research project, when completed, will be available for you to view. Please note that no where will you or your child's identity be revealed. Please feel free to contact me if you need any additional information regarding this research proposal.

Yours sincerely

Mr S E Thwala
sethwala@gmail.com
0735771979

I Mr /Ms/Mrs. [REDACTED] give permission to work and interview my child [REDACTED] for your CPUT Masters research project.

Signature..... [REDACTED] Date:..... [REDACTED]

APPENDIX 11: LEARNER CONSENT FORM



Cape Peninsula University of Technology

APENDIX F: CONSENT FROM PARTICIPANTS (LEARNERS AND PARENTS/GUARDIANS)

Faculty of Education
Ethics informed consent form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

| | | | | | | | | | |
|-----------------|--------------------------|----------|--------------------------|---------|-------------------------------------|-----------|--------------------------|----------|-------------------------------------|
| Principals | <input type="checkbox"/> | Teachers | <input type="checkbox"/> | Parents | <input checked="" type="checkbox"/> | Lecturers | <input type="checkbox"/> | Learners | <input checked="" type="checkbox"/> |
| Other (specify) | | | | | | | | | |

You are kindly invited to participate in a research study being conducted by SIBUSISO EMMANUEL THWALA from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

| | | | |
|---------------------------|-------------------------------------|-----------------------------|--------------------------|
| An undergraduate project | <input type="checkbox"/> | A conference paper | <input type="checkbox"/> |
| An Honours project | <input type="checkbox"/> | A published journal article | <input type="checkbox"/> |
| A Masters/doctoral thesis | <input checked="" type="checkbox"/> | A published report | <input type="checkbox"/> |

Date: 15 February 2021

I _____ (name of learner)

have been approached to participate in the research entitled: **The impact of teaching inference skills on the comprehension of word-problem sums in Grade 10 Financial Mathematics.**

I understand that:





- My participation in the research is voluntary;
- My participation in the research will not affect my position as a learner / teacher;
- I can refuse to answer any questions asked to me;
- I can withdraw from the research process at any time;
- The researcher will use information from me in a way that will assure my continued respect amongst other learners, teachers and colleagues;
- The information obtained will be used with the strictest confidentiality;

- My identity will not be disclosed in the thesis;
- Photographs of me will not be used in this thesis or any display related to the research;
- Learners rights will be respected; and
- The research interviews will not impact on my working time.

Kindly complete the table below before participating in the research.

| Statement | Tick the appropriate column | |
|--|-----------------------------|----|
| | Yes | No |
| 1. I understand the purpose of the research. | ✓ | |
| 2. I understand what the research requires of me. | ✓ | |
| 3. I volunteer to take part in the research. | ✓ | |
| 4. I know that I can withdraw at any time. | ✓ | |
| 5. I understand that there will not be any form of discrimination against me as a result of my participation or non-participation. | ✓ | |
| 6. Comment: | | |

Please sign the consent form. You will be given a copy of this form on request.

| | |
|---|--|
|  |  |
| Signature of participant | Date |
|  |  |
| Signature of parent/guardian | Date |

Researchers

| | Name: | Surname: | Contact details: |
|----|----------|----------|------------------|
| 1. | Sibusiso | Thwala | 0735771979 |
| 2. | | | |
| 3. | | | |

| | |
|---------------------------------|---|
| Contact person: Sibusiso Thwala | |
| Contact number: 0735771979 | Email: sethwala@gmail.com |