TEACHERS' EXPERIENCES AND ATTITUDES TOWARDS TEACHING NATURAL SCIENCES IN INFORMAL LEARNING ENVIRONMENTS: A CASE STUDY IN THE AMAJUBA DISTRICT

by

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DECLARATION

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Teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments: A case study in the Amajuba District.

I, Silindile Brightness Kubheka, declare that the above dissertation is my own work. All sources that I have used or quoted have been indicated and acknowledged by means of complete references. I further declare that I submitted the dissertation to an originality checking software and that it falls within the accepted requirements for originality. In addition, I declare that I have not previously submitted this work, for examination at Unisa for another qualification or at any other higher education institution.

02/08/2024

Signature Date

DEDICATION

With all my heart, I would like to dedicate this study to my beloved son, Nhlakanipho Kuhlekonke Ngwenya, and my sister, Sthembile Kubheka. May this serve as an encouragement in your academic journey, and if I am able to achieve this, surely you will achieve more than I did.

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ABSTRACT

Informal learning environments are among the most effective settings for enhancing learners' academic achievement in science subjects. They are expected to motivate learners to take responsibility for their own learning, thus increasing their interest in science subjects. Teachers are seen as an important element in promoting effective teaching and learning in these environments. However, their experiences and attitudes towards informal learning environments can influence their teaching in these environments. Thus, this study sought to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. This study was guided by the concept of informal learning environments and the curricular spider-web model, which was this study's conceptual framework. This study used a qualitative case study research approach which allowed for the exploration of teachers' experiences and attitudes. Purposive sampling technique was used to select participants who met the study criteria. Additionally, the study's objectives were used to select the participants who were appropriate for the study. The study involved seven participants from three different schools. The data was collected through reflective activities, semi-structured interviews, and focus group discussions with seven Natural Sciences teachers. Eight themes were generated using deductive thematic analysis. The research findings revealed that teachers have an understanding of informal learning environments, and acknowledge the positive impact of informal learning environments on learners' achievement and their professional development. Furthermore, the study's results revealed that teachers have positive attitudes towards teaching Natural Sciences in informal learning environments. However, the findings also revealed that schools located in rural areas still encounter problems related to resource shortages, which prevent the successful implementation of teaching in informal learning environments. This study involved only seven participants; therefore, the findings cannot be applied to all Natural Sciences teachers in the Amajuba District and across South Africa. This study recommends that a similar study be conducted on Further Education and Training (FET) phase teachers. This study also recommends that teachers must improvise to overcome any challenges they are facing when teaching in informal learning environments and to improve their teaching in these environments.

Keywords: Attitudes, Experiences, Informal Learning Environments, Natural Sciences, Senior Phase

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ABBREVIATIONS

CAPS- Curriculum and Assessment Policy Statement

DBE- Department of Basic Education

FET- Further Education and Training

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Literature has shown that teaching science in informal learning environments increases learners' achievements in science and science-related subjects (Sackey et al., 2015; Uludag, 2021). Furthermore, the literature revealed that informal learning environments are not only beneficial to learners, but also improve teachers' pedagogical knowledge (Popovic & Lederman, 2015). This study sought to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. The study also sought to investigate how teachers' experiences and attitudes influence their teaching of Natural Sciences in informal learning environments. This chapter presents the study background, the problem statement, the rationale for the study, the research questions, the aims and objectives, and concept clarification.

1.2 Background of the study

Studies have revealed that teaching and learning can occur in formal, non-formal and informal learning environments (Lindahl, 2007; Walan & Gericke, 2021). The formal learning environments include teaching science in an organised classroom setting (De-An et al., 2021). In informal learning environments, teachers teach science by taking learners to visit museums, national parks, out-of-school programmes, field trips to science centres, reading science books and doing research (De-An et al., 2021). The non-formal learning environment is a goal-oriented learning outside of school but with some kind of an organisational structure (Halonen, 2018). This study focused on teachers' experiences and attitudes toward teaching Natural Sciences in informal learning environments, as their experiences and attitudes affect how they teach and prepare learning activities in these environments (Walan & Gerick, 2021).

Informal learning environments have been shown to motivate learners to take responsibility for their own learning and feel a sense of belonging (Walan & Gericke, 2021). According to Lindahl (2007), informal learning environments increase learners' interests and positively influence their academic achievement as they understand content

better which contributes to their academic achievement. In addition, activities that are included in informal learning environments allow learners to develop scientific reasoning, gain scientific inquiry skills, as well as improve their communication skills (Walan & Gericke, 2021). Furthermore, informal learning environment activities have also been shown to motivate learners to take science, technology, engineering, and mathematics courses (Lindahl, 2007). Teachers are seen as an important element in promoting informal learning environments (Lindahl, 2007).

Literature shows that teachers' experiences and attitudes influence how they incorporate learning activities when teaching science subjects in informal learning environments (Lindahl, 2007; Walan & Gericke, 2021). Additionally, teachers' attitudes about science, informal learning, teaching and learning, and the nature of science influence science teachers' choices and decisions of pedagogical strategies (Sikko et al., 2012). Teachers' pedagogical knowledge and attitudes have also been shown to influence how teachers involve learners in informal learning environments (Cain et al., 2022). According to Duit and Treagust (2003), a science teacher should use different teaching strategies to make science topics easy to understand and for learners to perform well in the subject.

Research has shown that learners in rural schools in South Africa are not doing well in science subjects (Du Plessis & Mestry, 2019; Dierking & Falk, 2009). Du Plessis and Mestry (2019) elaborated on the major causes of underperformance in science subjects in rural areas. According to them, the shortage of resources to promote teaching and learning is one of the causes. They further stated that lack of resources also affects how teachers plan for informal learning environments (Du Plessis & Mestry, 2019). In addition, they argue that the Department of Basic Education finds it more difficult to supply rural areas with quality education services, which weakens the quality of teaching and learning in South Africa's rural areas.

The Department of Basic Education in School Performance Reports (2021) has revealed that most schools in rural areas perform badly in science-related subjects. One district that is not performing well in science-related subjects is the Amajuba District, which is located in KwaZulu-Natal Province (DBE, 2021). Many rural schools in the Amajuba District are not doing well in science subjects, and most do not have the resources for the

successful implementation of informal learning environments. Hence, this study sought to investigate teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments in the Amajuba District. This study was guided by the concept of informal learning environments and the curricular spider-web model which was this study's conceptual framework.

1.3 Rationale for the study

According to the Department of Basic Education in School Performance Reports (2021), learners are underperforming in science and science-related subjects in the Amajuba District. Therefore, there is a need to investigate strategies that can improve learners' performance. Teaching science in informal learning environments has been shown to be one of the best strategies to improve learners' performance in science subjects (Cain et al., 2003; Uludag, 2021). Teachers' experiences and attitudes have been shown to influence how they involve learners in informal learning environments when teaching Natural Sciences. Hence, it was important to undertake this study to understand teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Focusing on this study on Natural Sciences was important because when learners perform well in Natural Sciences, they are likely to also do well in the Further Education and Training (FET) phase. The findings of this study may encourage the use of informal learning environments in rural areas by Natural Sciences teachers. This study could also help in identifying the challenges faced by teachers in rural areas when teaching Natural Sciences in informal learning environments. In addition, gaining a better understanding of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments could help curriculum developers to examine the current Natural Sciences curriculum. Furthermore, this study might help curriculum developers to recognise the importance of ensuring that the curriculum is also promoting the use of strategies such as informal learning environments, which is known to improve learners' performance.

1.4 Problem statement

The goal of shifting the emphasis of science learning from teacher-centred to learner-centred is still not met (Shipton, 2022). The use of a teacher-centred approach prevents

learners from exploring science and achieving good marks in science and science-related subjects (Shipton, 2022). Furthermore, the teacher-centred approach does not provide learners with real-world experiences, as they are only reading and writing in the classroom, instead of being given an opportunity to explore science and make real-life connections. Literature shows that informal learning environments provide learners with opportunities to explore science (Lindahl, 2007). Additionally, informal learning environments are learner-centred, hence they can be used as one of the teaching strategies for science (Shipton, 2022).

According to the Department of Basic Education's (2019) annual examination analysis report, the Department has noticed an underperformance of learners in science and science-related subjects. The underperformance of learners in the Amajuba District is no different, as it was also low from 2019 to 2021. These results require an investigation of strategies that can be used to improve learners' performance in Natural Sciences and other related subjects. It has been reported by several authors that an informal learning environment as a teaching and learning strategy can influence learners' performance positively (Rogoff et al., 2016; Walan & Gericke, 2021). According to Rogoff et al. (2016), the use of informal learning environments can provide ways of supporting learners' learning of science in both classrooms and outside classrooms and thus improve their interests in science subjects. Informal learning environments provide learners with a hands-on experience and real-world experiences, which help learners to make connections and understand science content better (Lindahl, 2007). Melber (2005) argues that teachers' experiences with informal learning environments impact how they conduct informal learning environments. However, research shows that there is limited research in South Africa pertaining to teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Hence, this study sought to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

1.5 Purpose of the study

The purpose of this study was to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Furthermore, the study's

purpose was to explore lessons that can be drawn from teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

1.6 Aim and objectives

The aim of this study was to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. To achieve this aim, the following objectives guided the study:

- To identify and understand teachers' experiences of teaching Natural Sciences in informal learning environments.
- To identify and understand teachers' attitudes towards teaching Natural Sciences in informal learning environments.
- To identify and explore lessons that can be drawn from teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

The above objectives allowed the researcher to understand both the experiences and attitudes of Natural Sciences teachers when teaching in informal learning environments. Furthermore, the relationship between teachers' experiences and attitudes was obtained thus identifying lessons that can be learned from teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

1.7 Research questions

The study was guided by the research questions listed below.

The main research question

What are the teachers' experiences and attitudes toward teaching Natural Sciences in informal learning environments?

Secondary research questions

1. What are the teachers' experiences of teaching Natural Sciences in informal learning environments?

2. What are the teachers' attitudes towards teaching Natural Sciences in informal learning environments?

3. What lesson/s can be drawn from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments?

1.8 Concept Clarification

- **Formal learning environments**: This is the learning process that takes place in an organised classroom environment. Formal learning is planned and guided by an instructor, and it usually occurs in a formal face-to-face setting such as a classroom (De-An et al., 2021).
- **Informal learning environments**: This is the learning environment where the teaching and learning process takes place outside the classroom or school. It is used by teachers to teach learners outside the classroom in order to explore science. In informal learning environments, learners learn science by visiting museums and national parks, out-of-school programmes, and field trips to science centres (De-An et al., 2021).
- **Non-formal learning environments**: This is goal-oriented learning outside of school but with some kind of an organisational structure (Halonen, 2018).
- **Rural area**: This is an area that is located outside of cities and towns with a low population and small settlements (Rosalina et al., 2021).
- **Teacher-centred approach**: This is an approach where a teacher decides what to teach, how to teach, and how to assess the learning process. In this approach, the teacher uses direct instructions to teach (Shipton, 2022).
- **Learner-centred approach**: This is an approach where learners are given the opportunity to be involved in their learning process through active learning, problem-solving, and debates (Shipton, 2022).
- **Curriculum**: Refers to the lessons and learning content that learners learn in a particular course or programme (Lunenburg, 2011).
- **Natural Sciences teachers**: Teachers who are teaching Natural Sciences in the Senior Phase, grades 7-9.
- **Attitudes**: These refer to a set of beliefs, behaviours, and emotions towards a particular event, object, or person (Cherry, 2022).

- **Experience**: This is a situation or state where someone is being affected by or gaining knowledge by direct observation or engagement (Lutus, 2012).

1.9 Chapter outline

Chapter 1: Introduction

This chapter provided the introduction and background of the study. In addition, it stated the problem statement, rationale for the study, and research questions were presented. Furthermore, the study's aims and objectives, concept clarification and delimitation of the study were outlined.

Chapter 2: Literature review

This chapter presented a literature review on informal learning environments, which included a definition of informal learning environments, characteristics of informal learning environments, the benefits of informal learning environments in science curriculum and the challenges of implementing informal learning environments. In addition, the chapter provided comparisons of informal learning environments, non-formal learning, and formal learning. This chapter also reviewed literature on the experiences and attitudes of teachers toward teaching Natural Sciences in informal learning environments. Furthermore, this chapter expounded the conceptual framework of this study.

Chapter 3: Research methodology

This chapter provided the research methodology, which included the research paradigm, research approach, and research design. In addition, it outlined population and sampling, data collection tools, and data analysis. Furthermore, trustworthiness and ethical considerations were outlined in this chapter.

Chapter 4: Research findings and discussions

This chapter presented and analysed the data collected. Additionally, it provided the study's results and discussions. The data presentation was guided by the three research sub-questions and was presented according to themes.

Chapter 5: Summary, recommendations, and conclusions

This chapter presented the study's summary, limitations, recommendations and conclusions.

1.10 Delimitation of the study

This study only included teachers from the Senior Phase who have taught Natural Science for more than two years. In addition, this study was limited to five teachers and two Departmental Heads who were teaching in the Amajuba District's rural areas. The Amajuba District was chosen due to its accessibility to the researcher. It is worth noting that this research was conducted within the Amajuba District, Dannhauser Circuit, situated in the province of KwaZulu-Natal.

1.11 Chapter Summary

This chapter discussed the background of informal learning environments in science, followed by a problem statement and rationale for the study. The chapter provided an overview of the study's aims and objectives, research questions, and purpose. The following chapter described both the literature review and the conceptual framework that underpinned this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The previous chapter outlined the background of the study. This chapter reviews the literature by exploring research that has been done both nationally and internationally in relation to the study. The chapter begins with a description of the experiences and attitudes of teachers towards teaching Natural Sciences in informal learning environments, which was a phenomenon that was studied. Furthermore, the chapter defines informal learning environments, the benefits of informal learning environments, characteristics of informal learning environments and the challenges of informal learning environments. In addition, the chapter outlines the science curriculum in South Africa, and compares formal, non-formal, and informal learning. Lastly, the chapter discusses the conceptual framework of the study, which was the curricular spider-web and the concept of “informal learning”.

2.2 Experiences

In literature, experience is defined as a direct or indirect observation of events used as a source of information (Lutus, 2012). It has been explained that experience acquired over a long period of time improves a person’s capacity and competency in carrying out any given work (Lutus, 2012; Nyambe, 2015; Rice, 2010). Henry et al. (2012) pointed out that while experiences gained in the first few years of employment produce positive results, an employee’s passion and interest gradually wane as they become accustomed to the environment.

Teacher experience is a concept that has been defined in various ways by scholars. Zhang (2008) defines teacher experience as the number of years a teacher has spent in the classroom, but notes that simply having more years of experience does not necessarily make a teacher more effective in promoting learners’ achievement. In contrast, Ladd and Sorensen (2017) argue that novice teachers may be less effective

than experienced teachers. Furthermore, a teachers' experiences can be influenced by their working environment (Zhang, 2008). Teachers draw upon their experiences to select appropriate teaching strategies, content, and activities to help learners achieve the desired curriculum goals (Nyambe, 2015). Moreover, teachers' experiences shape their professional identities and influence their teaching practices, leading them to re-evaluate what matters in teaching and how they approach their work (Rice, 2010). Additionally, teachers use their experiences to analyse and implement the curriculum in diverse contexts (Zhang, 2008). Overall, understanding the complex concept of teacher experience is important for developing effective teacher education and professional development programmes that can support teachers in providing high-quality education to their learners.

The existing literature demonstrates that teachers' experiences play a crucial role in shaping how they engage learners in informal learning environments, especially in science subjects (Lindah, 2017; Walan & Gericke, 2019). In addition, research has shown that teachers' experiences with informal learning environments can significantly influence how they conduct activities in such settings (Melber, 2005). Therefore, it is important for teachers to have a clear understanding of informal learning environments to design effective and engaging learning experiences that benefit learners. Walan and Gericke (2019) suggested that teachers draw upon their experiences to create positive learning environments, even in cases where the school environment does not necessarily support informal learning activities. In a study conducted by Katz et al. (2013), teachers shared their experiences on the benefits of teaching science in informal learning environments, which included learners' excitement, engagement, and resilience. However, this aspect has not yet been thoroughly investigated in the South African context, especially in teaching Natural Sciences. As such, this study aimed to explore teachers' experiences of teaching Natural Sciences in informal learning environments.

2.3 Attitudes

An attitude is a complicated concept that refers to a set of beliefs, behaviours, and emotions toward a specific event, object, or person (Cherry, 2022). Van Aalderen-Smeets et al. (2012) define attitude as a psychological tendency to evaluate an object based on favourable or unfavourable attribute dimensions, which include positive/negative or good/bad. It is important to note that attitudes are shaped by past experiences and can have a significant impact on how individuals behave in various situations (Cherry, 2022). Additionally, attitudes tend to be stable and resistant to change once they have been formed, making them highly dependent on context (Cherry, 2022).

Cherry (2022) identifies three distinct types of attitudes: cognitive, affective, and conative. Cognitive attitudes reflect an individual's knowledge or belief about a particular object or event and can range from positive to negative evaluations of attributes along a continuum (Cherry, 2022). Affective attitudes, on the other hand, relate to a person's emotional response to an object or event, where a positive attitude is indicated by positive emotional reactions, while negative attitudes are indicated by negative affective reactions (Cherry, 2022). Finally, conative attitudes refer to the actions taken by an individual, which are influenced by their attitudes, and can be either overt or covert (Cherry, 2022). In this study, the three types of attitudes were used to explore teachers' attitude towards teaching Natural Sciences in informal learning environments.

Research has shown that there is a significant decrease in the number of learners pursuing careers in science (Thibaut et al., 2018; Van Aalderen-Smeets et al., 2012). This decline has been attributed to a lack of interest and motivation among learners as well as the perception that science is a difficult subject (Thibaut et al., 2018; Van Aalderen-Smeets et al., 2012). To address this issue, it is crucial that teachers develop positive attitudes towards science and increase their self-efficacy in teaching science (Van Aalderen-Smeets et al., 2012). According to Van Aalderen-Smeets et al. (2012), when teachers have positive attitudes towards science and perceive themselves as capable of teaching science, learners' interest in science is likely to increase. Moreover, teachers' attitudes towards science can significantly influence learners' perceptions of the subject

and how it is presented to them (Thibaut et al., 2018). Thus, it is important for teachers to recognise the impact of their attitudes towards science and to actively work towards developing positive attitudes towards the subject.

Walan and Gericke (2019) argue that teachers' attitudes towards informal learning environments have a significant impact on how they incorporate activities from these environments into science education. Teachers' attitudes towards science also play a critical role in motivating learners to pursue science subjects (Sikko et al., 2012). If teachers view science as a difficult subject, learners may lose interest in it (Sikko et al., 2012). Lei (2010) emphasises that teachers' positive attitudes towards informal learning environments can increase learners' participation in such environments. Teachers' attitudes towards their competence in informal learning environments can also influence how they deliver knowledge to learners (Thibaut, 2018). This was evident in the findings of a study by Ualesi and Ward (2018), where teachers felt that their passion and enjoyment of science had a direct positive effect on their attitudes towards teaching science in informal learning environments. Moreover, teachers' attitudes are significantly influenced by their experiences and the school context. However, there is limited research in South Africa pertaining to teachers' attitudes towards teaching Natural Sciences in informal learning environments. Therefore, this study aimed to explore teachers' attitudes towards teaching Natural Sciences in informal learning environments.

While the above statement is true, it is important to note that changes in attitudes alone may not be sufficient for real change to occur in informal learning environments. While attitudes can influence decision-making, other factors such as access to resources, support from school administration, and professional development opportunities can also play a critical role in promoting effective informal learning experiences (Sikko et al., 2012). Thus, a varied approach is needed to improve informal learning environments, which includes addressing teachers' attitudes, as well as other structural and contextual factors that impact informal learning environments.

2.4 Definition of informal learning environments

The literature review gives numerous definitions of informal learning environments. According to Coll and Coll (2018), informal learning environments are environments for learning that do not occur in a classroom or during formal schooling. They include museums, science centres, zoos, botanic gardens, and wildlife parks. Decius et al. (2019) argue that informal learning has no set objectives in terms of learning outcomes, but it depends on learners to solve problems and promote learning by doing, as they are actively involved in their own learning. In addition, informal learning environments help learners to make connections and understand science content better (Decius et al., 2019). Informal learning environments are not structured and are not based on classroom activities (Nygren et al., 2019). Nygren et al. (2019) further state that informal learning environments can be stimulated by formal learning.

Harrop and Turpin (2013) define informal learning environments as any learning activity involving the pursuit of understanding, skill, or knowledge that occurs in the absence of externally imposed curricular criteria. Furthermore, informal learning environments can be seen as an incidental, intentional, self-directed, and social form of learning (Harrop & Turpin, 2013). It has been explained that informal learning environments are non-didactic, as a learner has the freedom to choose how and what they engage with (Nygren et al., 2019).

Informal learning environments, as defined by Grimus (2017), are non-formal or non-classroom contexts where learning occurs through experiences and activities that are not covered by a formal curriculum. Museums, zoos, science centres, parks, and even homes are examples of these settings. Similar to this, Dierking and Falk (2009) define informal learning environments as locations that do not have a special focus on education but provide chances for learners to participate in self-directed, unstructured, and informal learning experiences. These venues encourage learners to explore their interests and passions while enabling the development of knowledge and skills that might not be covered in conventional classroom settings (Grimus, 2017). This current study adopted an informal learning environment definition by De-An et al. (2021). They define informal

learning environments as learning processes that take place outside the classroom or school. They further explain that during informal learning environments, teachers take learners to places where they can explore science, such as field trips and science centres (De-An et al., 2021).

2.5 Characteristics of informal learning environments

Informal learning environments do not follow any curriculum

According to Bell et al (2009), informal learning environments do not follow any curriculum, as the teacher is the one that decides where and when to take learners to informal learning environments to fulfil learners' needs. Informal learning environments are not planned or organised, as they do not have any set objectives for the teaching process (Bell et al., 2009).

Informal learning environments are controlled by learners

The literature has revealed that informal learning environments are controlled by learners, as teachers allow learners to freely choose what they engage in and the teacher does not fully control the flow of the activity (Toub et al., 2016). In informal learning environments, the teacher allows learners to choose the way to explore the content, which allows them to fulfil their own learning needs and become motivated towards science (Toub et al., 2016).

Informal learning environments promote positive attitudes and interests

According to Cheryan et al. (2017), informal learning environments promote positive attitudes and interests about science while preventing negative stereotypes about science. When learners participate in informal learning environments activities, they show interest and good achievement in science subjects (Cheryan et al., 2017). In addition, informal learning environments can provide learners with science development and rich opportunities for engagement, as it presents a variety of content through displays (Bell et al., 2009). Furthermore, learners become interested as informal learning environments

correlate science with everyday life. This was consistent with Avraamidou's (2015) findings, in which teachers shared that teaching science in informal learning environments helps learners grasp the nature of science, connects science to everyday life, and makes science more enjoyable and relevant.

The literature highlights some characteristics of informal learning environments, which can be summarised, according to Martin et al. (2016):

- Non-Structured: Informal learning environments are typically unstructured or loosely structured. They are not similar to formal learning environments, such as schools or training programmes, and there are no prescribed learning outcomes or syllabus.
- Self-Directed: Informal learning is usually self-directed, meaning that a learner decides what they want to learn and how they want to learn it. This allows for greater flexibility and customisation in the learning experience.
- Contextual: Informal learning often takes place in a real-life context, rather than in an artificial or abstract setting. For example, learning to cook by watching one's grandmother in the kitchen or learning a new language while traveling in a foreign country.
- Collaborative: Informal learning often involves collaboration with others, such as peers, family members, or mentors. This can be an important source of feedback, support, and motivation. Additionally, learners are able to collaborate with their teachers.
- Informal Assessment: Informal learning environments typically rely on informal methods of assessment, such as observation, self-reflection, or feedback from others. This can be less formal and less standardised than the assessment methods used in formal learning environments.
- Diverse Resources: Informal learning often involves a wide range of resources, including books, videos, websites, social media, and personal experiences. These resources may be curated by the learner or may be discovered through trial and error.

- Lifelong: Informal learning is often a lifelong process, continuing beyond formal education and into adulthood. It is often driven by personal interest, curiosity, and a desire to learn and grow. Informal learning environments is purposeful and thoughtful as learners are guided by the desire to acquire certain knowledge, attitudes and skills (Martin et al., 2016).

2.6 Benefits of teaching science in informal learning environments

Informal learning environments are among the best teaching and learning strategies in science subjects (Walan & Gericke, 2019). According to Lindah (2017), informal learning environments influence learners' academic achievement and motivate them to take science-related subjects. Sackey et al. (2015) argue that there are six benefits of informal learning environments in science subjects, namely; (1) learners are motivated by informal learning environments in nature, as informal learning environments are primarily driven by learners' interests; (2) learners use scientific inquiry practices such as predicting, testing, and questioning to make sense of the world; (3) learners generate, adapt, and understand science concepts better; (4) learners see science as a way of reflecting on and knowing about their own learning process; (5) learners participate in scientific activities and learn with others by using scientific tools and language; and finally (6) learners see themselves as contributors to science. Furthermore, informal learning environments help teachers link the theory they teach in the classroom with real-life experiences, which helps learners understand science better and become motivated towards science (Walan & Gericke, 2019). The benefits of learning and teaching Natural Sciences in informal learning environments are further explained below:

Benefits of informal learning environments for learners

Informal learning environments offer learners the opportunity for hands-on experiences and cognitive challenges that enhance their capacity for scientific reasoning (Gerber et al., 2001). Informal learning environments can address the limitations of formal learning settings, promoting engagement and participation among learners (Rogoff et al., 2016). Popovic and Lederman (2015) suggested that a more interactive and experiential

approach to science education in informal learning environments can motivate learners who struggle in traditional settings and foster their interest in the subject matter. Ince and Costu (2017) supported this view, emphasising the importance of learners' initiative, interest, and choice in informal learning environments. They further stated that teaching science in informal learning environments can reach learners who have difficulty understanding the material and provide them with holistic experiences that aid in long-term retention (Ince, & Costu, 2017). By using hands-on, play-based, and authentic contexts, informal learning environments allow learners to construct meaning from new knowledge (Denson, 2015). In the study findings of Adams (2020), teachers shared their experiences of teaching in informal learning environments, which included providing meaningful, creative, and innovative learning for their learners that goes beyond rote learning.

Informal learning environments foster a sense of personal accomplishment among learners, which can lead to more positive attitudes towards science and increased self-efficacy (Denson, 2015). This was evident in a study conducted by Gerber et al. (2001), which revealed that scientific reasoning abilities of learners with enriched informal learning environments were stronger compared to those with impoverished informal learning environments. These positive attitudes and self-efficacy are essential for developing intrinsic motivation towards science, which can have long-lasting benefits for learners' academic and career pursuits. Furthermore, informal learning environments have the potential to enhance learners' understanding of scientific concepts, as well as their interest and academic achievement in science (Popovic & Lederman, 2015). Additionally, informal learning environments encourage social interaction between learners as they exchange ideas and work together to solve problems, fostering deeper understanding of the subject matter (Rogoff et al., 2016). Gerber et al. (2001) argue that informal learning environments are particularly beneficial for developing learners' reasoning abilities, which are vital for comprehending scientific concepts and processes. Visiting places such as museums, zoos, and cultural events can motivate learners to participate in extracurricular activities in their communities (Rogoff et al., 2016).

Benefits of informal learning environments for teachers

Informal learning environments are expected to provide valuable opportunities for teachers to enhance their professional development. These settings allow teachers to engage in discussions and reflection on their pedagogy and educational philosophies, which can lead to a deeper understanding of their teaching practice while contributing to their professional development (Popovic & Lederman, 2015). In addition, informal learning environments can also play a crucial role in developing teachers' subject matter knowledge through exposure to diverse content in informal learning environments, which is a critical aspect of effective teaching (Popovic & Lederman, 2015). By participating in these environments, teachers can acquire new insights, strategies, and techniques that can ultimately enhance their teaching and improve learners' learning outcomes. This was similar to the study findings of Adams (2020), who found that informal learning environments can assist teachers improve their teaching strategies and develop confidence in science teaching.

In addition, informal learning environments can provide teachers with the opportunity to cater to learners' needs by selecting engaging content (Falk et al., 2007). Rogoff et al. (2016) suggested that such environments allow teachers to support learners' individual interests and initiatives, facilitating their comprehension and organisation of new material for long-term retention. Popovic and Lederman (2015) asserted that these environments promote teaching through real-world modelling and examples, enhancing the relevance of the material being taught (Popovic & Lederman, 2015). However, there is limited research in South Africa pertaining to teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. As such, this study sought to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

2.7 Challenges of teaching science in informal learning environments

While informal learning environments have been extensively discussed for their benefits, it is important not to overlook the challenges that come with them. The literature has

identified several obstacles, such as field trip logistics, lack of structure and guidance, teachers' knowledge, learners' behaviour, inadequate resource and funding (Behrendt & Franklin, 2014; Du Plessis & Mestry, 2019; Lopez & Caspe, 2014). These factors can affect the effectiveness of informal learning environments and require careful consideration. These factors are discussed below;

Lack of resources and funding

It has been acknowledged that informal learning spaces such as museums, libraries, field trips and science centres are crucial for fostering lifelong learning and increasing learners' achievement. According to Du Plessis and Mestry (2019), numerous schools in rural areas have a challenge of funding and lack of resources. Since many of these schools struggle with low funds and resources, this can make it difficult for them to offer high-quality informal learning opportunities. The lack of funding for programmes and activities in informal learning environments is one of their biggest challenges. This resonates with a study conducted by Turkmen and Kaplan (2021), which revealed that teachers have challenges with preparing informal learning environments visits due to low school budgets. Falk and Dierking (2013) argue that rural schools are supported by grants, donations, and other types of outside funding. Yet, the availability of such money can be incredibly unpredictable, which can cause financial instability and make teaching design and implementation challenging (Falk & Dierking, 2013).

Literature further revealed that the quality of teaching science in informal learning environments can also be impacted by a lack of resources (Du Plessis & Mestry, 2019; Falk & Dierking, 2013). Lack of resources can result in reduced levels of engagement and participation among museum visitors and other informal learning environments (Falk & Dierking, 2013). Similarly, Du Plessis and Mestry (2019) noted that community centres with limited financing and resources were less able to offer variety of learning possibilities in informal learning environments.

In conclusion, informal learning environments have challenges due to a lack of financing and resources, but there is also evidence that these settings can function well even with minimal resources. To further understand how informal learning environments might

maximise teachers' impact given the limitations they encounter, more research is required.

Challenges in learners' engagement

Engaging learners in informal learning environments can be difficult, especially when compared to formal learning contexts (Kisiel, 2005). Ineffective learners' engagement in informal learning environments can be caused by a number of reasons, according to a review of the relevant literature. One contributing issue is the absence of structure and direction in informal learning environments (Kisiel, 2005). In formal learning environments, learners frequently receive explicit objectives as well as guidance on how to achieve them. As a result, it can be challenging for learners to understand what they should be learning or how to go about it in informal learning environments, which frequently lacks this framework, as teachers do not know how to teach in these environments (Simsek & Kaplan, 2022). Another aspect is the absence of evaluation and feedback in informal learning settings (Kisiel, 2005). In formal learning environments, learners regularly receive feedback on their development and performance, which can motivate learners and help them to make progress. However, in informal learning environments, feedback is not always available, which can make it difficult for learners to know if they are progressing or not (Kisiel, 2005).

In formal learning environments, learners frequently have the opportunity to connect with teachers and peers, which can serve as a source of inspiration, criticism, and encouragement. However, learners may not have access to these same tools in informal learning environments, as learning may be conducted by a facilitator, which can make learning challenging (Kisiel, 2005). Furthermore, learners may encounter difficulties due to the absence of external incentives (Kisiel, 2005). In formal learning, grades, diplomas, or other awards may serve as incentives for learners. Yet, these outside incentives might not be present in informal learning environments, which can make it challenging for learners to remain motivated and devoted to their studies (Simsek & Kaplan 2022).

Informal learning environments can be advantageous to learners in that they can provide them with flexibility and autonomy, but these environments can also pose difficulties. To

overcome these difficulties, teachers and curriculum developers may need to include an additional structure, feedback and external motivation in informal learning environments.

Field trips visits

Behrendt and Franklin (2014) argue that field trip venues present fancy displays that often obscure the real science within the exhibit. Exhibit colours can be disruptive to learners as they tend to focus on the beauty of the exhibition instead of the underlying science concept (Behrendt & Franklin, 2014). Furthermore, novel field trip situations can be problematic as they create an adjustment process that directs teaching attention towards the new environment, and field trips portray science as easy and unproblematic (Behrendt & Franklin, 2014). Field trip arrangements and planning take a lot of responsibility while other learners end up not attending the trip (Photo, 2022). Teachers dissociate themselves from learners in an informal learning environment due to a lack of experience in preparing out-of-school academic trips (Keisel, 2005). According to Behrendt and Franklin (2014), teachers believe that planning for visits to informal learning environments takes too much time and money. When planning a field trip, the school must obtain parental consent as well as a contribution for transportation. As a result, teachers become irritated and avoid planning informative field trips for their learners which prevents learners from exploring science (Behrendt & Franklin, 2014).

Teachers' knowledge

According to Lopez and Caspe (2014), one of the main challenges in teaching science in informal learning environments is the lack of knowledge and recognition of the various learning opportunities that these environments can provide. Teachers tend to view field trips as extracurricular and often fail to link classroom lessons with the field trip experience. Additionally, many teachers are not familiar with the philosophy and organisation of informal learning environments, which leads to a lack of interest in taking learners to these settings (Lopez & Caspe, 2014). Furthermore, teachers may not realise how informal learning environments differ from classroom settings and how the two settings can complement each other (Lopez & Caspe, 2014). Simsek and Kaplan (2022)

noted that although teachers regard an informal learning environment as an important place to teach science, they are unable to teach in these settings.

In summary, the literature indicates that teachers encounter challenges when teaching science in informal learning environments. These challenges are outlined in this section. To understand some of these challenges, this study aimed to develop a better understanding of teachers' attitudes and experiences when teaching Natural Sciences in informal learning environments.

2.8 Natural Sciences Curriculum in South Africa

The Natural Sciences curriculum in South Africa has experienced various revisions throughout the years, with a focus on establishing a curriculum that is more relevant to the needs of learners and society as a whole. According to research by Erduran and Msimanga (2014), South Africa's science curriculum has experienced major modifications over the years, with an emphasis on encouraging inquiry-based learning and fostering learners' scientific literacy. According to Erduran and Msimanga (2014), the present science curriculum in South Africa strives to increase learners' knowledge and understanding of science ideas, as well as their capacity to apply this knowledge to real-world issues. Another study by Du Plessis and Mestry (2019) emphasised the significance of adapting the science curriculum to South African learners' needs and experiences, particularly those from underprivileged backgrounds. The literature indicates that South Africa's science curriculum is constantly changing to fit the demands of learners and society, with an emphasis on encouraging scientific literacy, critical thinking, and inquiry-based learning, participating in real-world and practical activities instead of rote memorisation (Erduran & Msimanga, 2014). This study focused on Natural Sciences teachers.

The current Natural Sciences curriculum for Grades 7-9 promotes learning by doing, where learners are encouraged to learn science by being actively involved in their learning process. The learner-centred approach is strongly emphasised in the current Natural Sciences curriculum and teachers are encouraged to use this approach to help

learners comprehend science content and acquire scientific literacy (Department of Basic Education, 2011). The Natural Sciences curriculum has been reformed to encourage learners to make informed and balanced choices about how science and technology impact their lives and to solve problems using scientific knowledge. The incorporation of inquiry-based learning within the context of informal learning environments in science curricula has been the best approach to achieving this (Ince & Costu, 2017). This has also been achieved by ensuring that the curriculum includes information that learners encounter in their daily lives so that they can easily relate the information that they are learning to what they already know (Ince & Costu, 2017). According to Du Plessis and Mestry (2019), the Natural Sciences curriculum in South Africa faces several difficulties, which include a lack of suitable resources, experienced science teachers, and a curriculum that is not always relevant to learners' needs.

The Natural Sciences curriculum aims to produce learners who are able to do the following:

- Identify, solve, and make decisions based on critical and creative thinking.
- Demonstrate effective teamwork and individual performance.
- Manage oneself and their activities responsibly and effectively.
- Gather, analyse, organize, and evaluate information critically.
- Communicate effectively through visual, symbolic, and/or linguistic skills in various modes.
- Demonstrate responsible use of science and technology for environmental and human health.
- Understand the world as a collection of interconnected systems, acknowledging that problem-solving situations do not exist in isolation" (Department of Basic Education, 2011, p5).

It can be noted that the Natural Sciences curriculum promotes the use of informal learning environments. It is stated that teachers should involve learners in informal activities using the allocated time which is clearly stated in the Curriculum Assessment Policy Statement (CAPS). However, there are still a number of issues that need to be resolved, such as

resource limitations, a lack of teachers, and the requirement for a curriculum that is more relevant to the needs of learners. Hence, this study sought to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

2.9 Comparison of informal learning, non-formal learning and formal learning

Non-formal learning is defined as learning that is based on experiences that are neither planned nor organised (Pilz & Wilmshofer, 2015). It is explained that non-formal learning can be seen as an activity that promotes learning outside formal learning (Pilz & Wilmshofer, 2015). Furthermore, non-formal learning is an organised and systematic learning activity that occurs outside formal learning environments. Formal learning is defined as planned, organised, structured learning, which leads to formal recognition such as certificate (Pilz & Wilmshofer, 2015). Informal learning is described as non-organised learning that takes place in social institutions such as peer groups and involves everyday experiential learning (Pilz & Wilmshofer, 2015)

The literature has also revealed that the combination of formal, non-formal and informal learning provides learners with knowledge, scientific thinking and an understanding of science (Ainsworth & Eaton, 2010; Johnson & Majewska, 2022). Therefore, teachers should use these three forms of learning to support learners in learning science. Table 2.1 below outlines the comparison of formal, non-formal and informal learning.

Table 2.1: Comparison of formal, non-formal and informal learning (Pilz & Wilmshofer, 2015)

Formal learning	Non-formal learning	Informal learning
Learning is intentional, organised, structured, follow curriculum or program and have learning objectives	Learning may or may not be organised or intentional.	Learning is never organised, no set objectives and learning does not take place in formal setting.

Learning is led by professionals and experts.	Learning can be led by someone with more experience with or without formal training.	Learning can be led by anyone with or without experience and formal training
Take place inside classroom settings.	Take place outside classrooms settings.	Take place outside classroom settings.
Follow a syllabus.	Might follow a syllabus.	Does not follow a syllabus.
Learning is compulsory.	Learning is usually voluntary.	Learning is voluntary.
Extrinsic motivation.	Typically intrinsic motivation.	Intrinsic motivation.
Learning outcomes are measured.	No assessment.	No assessment.

2.10 Conceptual framework

The conceptual framework of this study was based on the constructs of informal learning environments and the curricular spider-web. Informal learning environments and the curricular spider-web have assisted in understanding teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. The components of the curricular spider-web guide what is expected from teachers and learners for successful teaching and learning in informal learning environments. According to Kazempour (2013), teachers' attitudes and experiences towards teaching Natural Sciences in informal learning environments can be viewed through the curricular spider-web model.

Informal learning environments

Informal learning environments entail a learning process that takes place outside the classroom or school (De-An et al., 2021). Sackey et al. (2015) define informal learning environments as a learning approach that is unstructured and places the needs and interests of learners in their hands. They further argue that informal learning environments

are often used by teachers to teach learners about science to satisfy short-term personal needs in science and improve learners' performance (Sackey et al., 2015). This study adopted an informal learning environment definition as any learning that takes place outside classrooms or schools (De-An et al., 2021).

Curricular spider-web model

In 2003, a model of a curricular spider-web was created by Van den Akker. The vision, goals, and objectives, content, learning activities, the teacher's role, tools and resources, grouping, location, time, and assessment are the ten (10) elements that make up the curricular spider-web model. According to Van den Akker et al. (2009), putting all the concepts into practice will guarantee consistency and applicability across all curriculum components, especially the informal learning environments, which was the focus of this study. For this study, the term learning in each component was replaced with the term teaching. The model of curricular spider-web is shown in Figure 2.1 below:

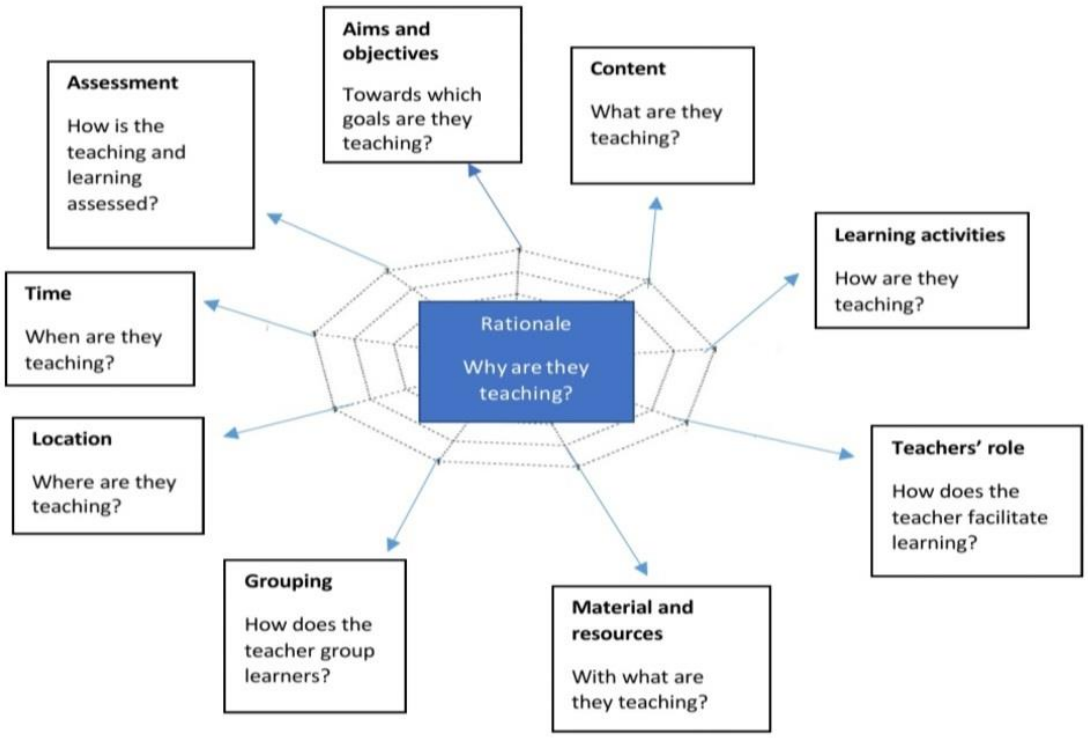

***Figure 2.1**: A model of curricular spider-web (Adopted from Van den et al., 2009).*

Since the focus of this study was on teachers, the following questions were raised:

Table 2.2: Curricular spider-web model questions related to the study

Components	Questions
Vision	Why are they teaching in informal learning environments?
Aims and objectives	Towards which goals are they teaching in informal learning environments?
Content	What are they teaching in informal learning environments?
Materials and resources	With what are they teaching in informal learning environments?
Location	Where are they teaching in informal learning environments?
Teachers' role	How does the teacher facilitate teaching in informal learning environments?
Learning activities	What activities do teacher give learners in informal learning environments?
Grouping	How does the teacher group learners during informal learning environments?
Time	When does the teacher take learners into teaching in informal learning environments?
Assessment	How does the teacher assess learners in informal learning environments?

Vision

According to Van den Akker et al. (2009), vision serves as a crucial link in the curricular spider-web since it explains why a certain topic or subject is taught. To ensure the effectiveness of the teaching and learning process, teachers must make decisions about what to teach and how to teach it. The literature has revealed that informal learning environments are utilised by teachers to assist learners in getting a better understanding of the subject content and connecting what they are learning in the classroom with what they are experiencing outside of the classroom (Walan & Gericke, 2019). Furthermore,

informal learning environments have been shown to increase learners' achievements in science and help learners understand content better (Walan & Gericke, 2019).

Aims and objectives

This component of the curricular spider-web web refers to the goals towards teaching (Van den Akker et al., 2009). Sachs (2017) define goals as to what learners and teachers expect to obtain at the end of the lesson. According to the Natural Science CAPS document, Natural Science consists of three specific aims, which are: 1) practicing science, 2) knowing the subject matter and establishing connections, 3) understanding the uses of science. In informal learning environments, teachers are expected to link the theory that learners have learned in the classroom with what they are learning in these environments, thus increasing learners' academic performance and developing scientific reasoning, which is specific aim 2 (Walan & Gericke, 2019). According to Gerber et al. (2001), one of the aims of teaching learners in informal learning environments is to help learners develop social interaction and encourage them to participate in extracurricular activities, which is specific aim 3. Rogoff et al. (2016) assert that teachers take learners into informal learning environments to deepen their understanding of the problem, which is specific aim 1.

Content

According to Van den Akker et al. (2009), content is what the teacher imparts to learners. The curriculum for Natural Science is structured into four strands, including Life and Living, Matter and Materials, Energy and Change, as well as Planet Earth and Beyond, according to the Natural Science CAPS document. Teachers are expected to employ a variety of instructional techniques to engage learners in informal learning environments so that they can understand Natural Sciences outside the classroom. In informal learning environments, teachers can teach any Natural Sciences content since there is no specific content that should be taught in these environments. In informal learning environments, a teacher decides what to teach learners and how to teach lessons.

Learning activities

This component of the curricular spider-web refers to how teachers are planning their lessons and the activities that learners are involved in (Van den Akker et al., 2009). When teaching science in informal learning environments, teachers take learners to places outside the school such as museums, zoos, participating in out-of-school programmes, visiting science centres, researching, and reading science books (De-An et al., 2021). Furthermore, teachers involve learners in informal learning environments by doing activities such as practical, investigations, and research, which are all part of the Natural Sciences curriculum (De-An et al., 2021).

Teachers' role

This component of the curricular spider-web refers to how the teacher facilitates teaching (Van den Akker et al., 2009). In informal learning environments, a teacher is expected to use a learner-centred approach where learners are given the opportunity to take responsibility for their own learning and explore science by being involved in different learning activities. The role of a teacher during informal learning environment activities is to explain the learning activities to learners and observe them during the activity to guide them and ensure that they are obtaining the learning objectives. The teacher must also assess if learners understand the purpose of the activity to ensure that they do not have any misconceptions.

Materials and Resources

Resources are the teaching and learning resources that a teacher will use to create effective learning environments (Van den Akker et al., 2009). Van den Akker et al. (2009) emphasise the importance of materials and resources in teaching and learning and how they affect how a teacher will conduct the lesson. In informal learning environments, the resources that a teacher will select depend on where the learning will take place and the type of learning being carried out by learners. Du Plessis and Mestry (2019) argue that the availability of resources affects how a teacher plans and involves learners in informal learning environments. They further explained that the shortage of resources in schools

is one of the reasons why teachers might not involve learners in informal learning environments because schools might not have the resources necessary for implementation of informal learning environments; therefore, teachers need to improvise, which is difficult (Du Plessis & Mestry, 2019).

Grouping

Van den Akker et al. (2009) explain this component of the curricular spider-web as the one that shows how teachers group learners for teaching and learning. Thus, it becomes clear whether learners are learning individually or in groups. In informal learning environments, teachers usually use collaborative learning, where learners learn in groups. This is because informal learning environments are outside the classroom, thus learners are able to share their experiences while exploring science, which also promotes social interaction between learners.

Location

Van den Akker et al. (2009) define location as a place where teaching and learning occur. The literature has revealed that informal learning environments encapsulate learning processes that take place outside the classroom or school (De-An et al., 2021). Teachers teach learners Natural Sciences by visiting science centres, zoos, national parks, and museums (De-An et al., 2021).

Time

Time is described by Van den Akker et al. (2009) as when teaching and learning take place. In the Natural Science Grades 7-9 CAPS document, time allocation is outlined to help teachers choose how much time should be spent on activities. The CAPS document states that informal learning activities are a crucial part of the teaching and learning process, therefore, a teacher is expected to spend some time involving learners in informal learning (Department of Basic Education, 2011). There is no specific time for informal learning environments; therefore, it is up to the teacher to decide if the topic requires learners to be taken to an informal learning environment.

Assessment

Kuh et al. (2014) define assessment as a process of evaluating the teaching and learning process. They further explained that assessment should be connected to learning goals and learners must be given regular feedback (Kuh et al., 2014). The Natural Sciences CAPS document explains how learners should be assessed for informal learning environments (Department of Basic Education, 2011). A teacher is anticipated to assess learners during the activities completed in an informal learning environment to determine if learners have obtained the desired learning outcomes.

2.11 Chapter Summary

This chapter provided a comprehensive literature review of the study, which focused on the experiences and attitudes of teachers towards teaching Natural Sciences in informal learning environments. It covered previous research conducted both nationally and internationally, including the definition, benefits, and challenges of informal learning environments, as well as the characteristics of informal learning environments and the science curriculum in South Africa. The chapter also presented the conceptual framework of the study. The upcoming chapter will discuss the research design and methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research paradigm that was used to study teachers' experiences and attitudes toward teaching Natural Sciences in informal learning environments. This chapter elaborates on the sampling technique utilised to select participants. In addition, this chapter provides data collection methods and data analysis procedures. Lastly, the study's trustworthiness and ethical considerations are discussed. Table 3.1 below outlines the summary of the research methodology of this study.

Table 3.1: Summary of research methodology (Adopted from Zaca, 2018)

Research focus areas	Research discussion point
Research questions	Main question: • What are teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments? Sub-questions: • What are teachers' experiences of teaching Natural Sciences in informal learning environments? • What are teachers' attitudes towards teaching Natural Sciences in informal learning environments? • What lesson/s can be drawn from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments?
Research paradigm	Interpretivist

Research approach	Qualitative
Research design	Case study
Sampling	Purposive sampling
Data collection techniques	• Reflective activity • Semi-structured interviews • Focus group discussions
Data analysis	Thematic analysis

3.2 Research paradigm

In 1962, Thomas Kuhn introduced the term “paradigm” to refer to a conceptual framework used by scientists to analyse issues and arrive at solutions. Kuhn defined a paradigm as a research culture comprising shared beliefs, assumptions, and values governing the purpose and conduct of research. Additionally, Thanh and Thanh (2015) characterised a paradigm as the structure, framework, and patterns of scientific and academic ideas, values, and assumptions. According to Cohen and Howe (2011), each research paradigm adopts a particular perspective for observing the social world and selecting an approach for studying the phenomenon. Furthermore, a paradigm is used in research that involves human behaviour with the aim of improving the credibility and generalisability of the study (Cohen & Howe, 2011). Alharahsheh and Pius (2020) assert that a paradigm has four components, namely: ontology, epistemology, methodology and methods. The paradigm adopted for this study was the interpretivist paradigm.

3.2.1 *Interpretivist paradigm*

For this study, an interpretivist paradigm was chosen. Interpretivist paradigms, as Reeves and Hedberg (2003) suggest, prioritise contextualising analysis and focus on people’s subjective experiences of the world. Approaches such as interviews and participant observation, which prioritise meaning, are utilised in interpretivist paradigms. Bertram and Christiansen (2014) assert that the interpretivist paradigm aims to formulate single or multiple social realities that present themselves as problems or issues. They further

explain that this paradigm enables researchers to investigate and acknowledge social life and is particularly suitable for studies involving human subjects (Bertram & Christiansen, 2014).

In this study, the interpretivist paradigm was suitable as the study involved exploring teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. By adopting an interpretivist paradigm, the study allowed for an in-depth exploration of teachers' experiences and attitudes from their perspectives. This paradigm was suitable for this study, as it involved research methods such as interviews, focus groups and reflective activity, which were the data collection methods used in this study. The use of interpretivist paradigm allowed the researcher to investigate the complexities of teachers' experiences and attitudes, shedding light on the context of informal learning environments and to determine if there were any contextual factors influence Natural Sciences education practices in these environments.

The interpretivist paradigm allowed the researcher to explore the social and cultural factors that shapes teachers' views, teaching environments, their interaction with learners and how they construct meaning and understanding in their teaching practices. Furthermore, this approach allowed the researcher to explore how teachers' attitudes towards teaching Natural Sciences in informal learning environments are shaped by factors such as educational background, professional developments experiences and institutional support. Lastly, the interpretive paradigm allowed the researcher to take into account behavioural aspects based on participants' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

Ontology

It is defined as the nature of reality, as it is mainly concerned with the phenomenon with regard to its nature of existence. It seeks to address the research topic by referring to existing types of knowledge (Alharahsheh & Pius, 2020). It assists in understanding the structure and nature of reality, as well as what one believes one can learn about it (Alharahsheh & Pius, 2020).

Epistemology

It is defined as how the researcher knows reality and how the researcher aims to uncover knowledge to reach the reality. It shapes the researcher's approach to gather, interpret, and validate knowledge (Alharahsheh & Pius, 2020). It focuses on the nature and forms of human knowledge and comprehension that a researcher can acquire to deepen their understanding in their field of study (Alharahsheh & Pius, 2020).

3.3 Research approach

This study employed a qualitative research approach. According to Denzin and Lincoln (2003), qualitative research is naturalistic since it examines various groups of people's daily activities in their natural environments. They also argue that qualitative research interprets phenomena in the context of the meaning individuals assign to them. Cohen and Howe (2011) further explain that qualitative research aims to understand social life by generating data in words. According to Creswell (2014), qualitative research is a type of inquiry that tries to understand social problems and is undertaken in a natural situation with the purpose of studying humans. Qualitative research describes the event, circumstances, attitudes, and opinions of the participants (Creswell, 2014).

Given that the study's aim was to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments, the qualitative research approach was suitable for obtaining the study's goals and in answering the research questions. This approach allowed for an in-depth investigation of the experiences and attitudes of the participants. Furthermore, this approach was appropriate because it permitted the exploration of the complexities and richness of the participants' perspectives. The qualitative research approach allowed the researcher to capture the details of the participants' experiences and attitudes towards teaching Natural Sciences in informal learning environments, thus providing a deeper understanding of the phenomenon (Creswell, 2014). Finally, this approach was suitable for this study because of the following reasons:

- It allowed the researcher to receive data in the form of descriptions and words instead of numerical data as in the quantitative approach.
- This approach provided opportunities for interpretation and clarification of the phenomenon being studied.

3.4 Research design

This study employed a case study research design, which is a research method used to investigate a group of people, an event, a person, or an organization, as defined by Bertrum and Christiansen (2014). This approach allowed for an in-depth investigation of teachers' experiences and attitudes towards teaching science in informal learning environments. McMillan and Schumacher (2014) state that a case study focuses on analysing context for a limited number of events or conditions and their relationships. Additionally, Creswell (2014) explains that a case study is an in-depth study of individuals, activities, processes, or events based on wide data collection. The qualitative case study was appropriate for this research since it allowed for an analysis of the phenomenon in its context utilising various data-generation methods (Baxter & Jack, 2008). In addition, the use of a case study was appropriate because it allowed the researcher to better understand contextual factors contributing to teachers' attitudes and experiences. Furthermore, this approach provided an exact picture of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments, which was critical to answering the study's research questions (Yin, 2009).

According to Lincoln and Guba (1985), there are six types of case studies namely, descriptive case study, explanatory case study, intrinsic case study, instrumental case study, exploratory case study and collective case study. This study employed an instrumental case study design. An instructional case study is defined by Lincoln and Guba (1985) as a research method that is used to study a specific case to gain a deeper understanding of a phenomenon or concept. They further explained that the case that is selected is used as an instrument to answer the research question. An instrumental case study was appropriate for this study since the aim of the study was to explore teachers' experiences and attitudes towards teaching science in informal learning environments.

This approach allowed the researcher to understand participants' attitudes and their experiences better and to further understand informal learning environments' contextual factors and how these factors influence teachers' attitudes and experiences towards teaching Natural Sciences in informal learning environments. Furthermore, an instrumental case study was suitable for this study as it allows the use of different data generation methods which enabled the researcher to triangulate the study findings and enhance the validity of the study. Furthermore, the case study was appropriate for this study for the following reasons:

- It allowed the researcher to set aside natural attitudes and other influencing factors when collecting the data to ensure that the collected data revealed participants' experiences and attitudes.
- It allowed for an in-depth investigation of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.
- It allowed for an analysis of the phenomenon in its context utilising various data-generation methods such as interviews, focus group discussions and reflective activity, which provided triangulation and increased the validity of the data (Baxter & Jack, 2008).
- This approach allowed the researcher to better understand if there were any contextual factors contributing to teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments, which was critical to answering the study's research questions.

3.5 Selection of participants

Sampling is a crucial aspect of research as it helps researchers select a representative group from the population being studied. Bertram and Christiansen (2014) elaborated on sampling by defining sampling as the process of making choices about the subjects, activities, and environments to be included in a study. They highlighted the importance of sampling, stating that it enables researchers to draw conclusions about a particular group of participants from a sample, which helps in achieving research aims. In this study, purposive sampling was used as it allowed the researcher to make deliberate decisions

about which individuals to include in the study based on the research objectives. Purposive sampling is a technique employed by researchers to select participants based on specific criteria (Bertram & Christiansen, 2014). Therefore, the study objectives were used to select the participants suitable for the research. This approach enabled the researcher to gather rich and relevant data to address the research questions. When using the study objectives to select participants the following were taken into consideration:

- Target population- the target population for this study were teachers who had experience in teaching Natural Science with diverse backgrounds and varying levels of experience.
- Inclusion criteria- all participants had a minimum of two years' experience in teaching Natural Science.
- Geographical location- all participants were selected from the same Circuit.
- Screening and selection- all potential participants were screened based on the inclusion criteria to ensure that all participants had relevant teaching experience.
- Sample size- an appropriate sample size was selected based on the goals of the study.
- Data collection- the data was collected using reflective activity, interviews and focus group discussion.

In this study, the sample involved teachers from the Amajuba District under the Dannhauser Circuit and they were teaching Natural Sciences in the Senior Phase. It was important to collect data from Senior Phase teachers because the literature has shown that when learners get a good science background in the early Grades, they are likely to do well later in their lives (Denson, 2015). The study sampled five teachers and two Science Departmental Heads from three different schools. The reason for including Departmental Heads was to get a deeper understanding of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments because they are expected to have more knowledge in the subject and attend advanced training. This study involved a small sample size which may raise questions regarding the findings' generalizability. Despite this constraint, the perceptions collected from these teachers add

dimension to the study and provide useful context-specific data. Furthermore, in qualitative research, sample sizes are often modest, with size selection mostly determined by the study's unique aims (Maree, 2016). The goal of this study was not to pursue representativeness or generalizability, as advocated but rather to obtain rich and detailed descriptions of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Sampling was done using the following criteria, which were guided by the study objectives:

- All participants were teaching Natural Science in the Senior Phase.
- Participants were teaching in the Amajuba District under the Dannhauser Circuit.
- Participants had a recognised teaching qualification and a minimum of two years of teaching experience.
- Participants were willing to participate and understood that their participation was voluntary.

The table below shows the participants' profiles, which included their academic qualifications, gender and teaching experience as well as their visits to informal learning environments. Participants' pseudonyms were Ms Biyela, Mr Sithole, Ms Shange, Ms Gama, Mrs Vilakazi, Mr Dube, and Mr Mbatha.

Table 3.2: The participants' profiles

Participants	Gender	Qualification	Years of experience	Visit in informal learning environments
Ms. Biyela	Female	• B. Ed	10	Yes
Mr. Sithole	Male	• Diploma in Analytical Chemistry • PGCE	7	Yes

Ms. Shange	Female	• BSc • PGCE • B. Ed (Honours)	4	Yes
Ms. Gama	Female	• B. Ed • B. Ed (Honours)	5	Yes
Mrs. Vilakazi	Female	• Diploma in Education	15	Yes
Mr. Dube	Male	• Diploma in Education • Advanced certificate in Education	23	Yes
Mr. Mbatha	Male	• B. Ed	2	Yes

3.6 Data collection

To get an understanding of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments, the data was collected through reflective activities, interviews and focus-group discussions which were piloted before data generation. Two participants were given a reflective activity (appendix G), two participants were interviewed (appendix H) and three participants were involved in the focus group discussions (appendix I). According to Cohen and Howe (2011), a focus group discussion must have a minimum of three participants and a maximum of 12 participants therefore this study used three participants for a focus group discussion in order to meet this criterion.

3.6.1 Reflective activity

According to Bertram and Christiansen (2014), a reflective activity is a task that participants are given to assess their level of familiarity with and comprehension of the

subject matter of the study and to consider their personal experiences with the phenomena under investigation. Milam (2008) argues that during the reflective activity, participants are given a written task and asked to respond to inquiries pertaining to the study phenomenon. Bertram and Christiansen (2014) assert that a reflective activity allows one to pay attention to their experiences and attitudes and take wise actions and decisions in the future. Reflective activity was appropriate in this study as it allowed teachers to look deeper into their own experiences, attitudes, and contextual factors that influence their teaching in informal learning environments.

In this study, two participants were given a reflective activity to complete before the interview and focus group discussions. The reflective activity questions of this study were aligned with the exploration of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. To give participants enough time to answer the reflective activity questions, the researcher allowed the participants to complete the reflective activity on their own time, and there was a mutual understanding between the participants and the researcher for the time frame to complete the reflective activity. Thus, reflection allowed participants to describe their experiences in their own time without the researcher's pressure. The activity was explained thoroughly to participants to ensure that they understood what was expected of them. The reflective activity was aligned with the ten strands of the curricular spider web, which was the study conceptual framework. This covered reflection on questions such as:

- What are informal learning environments?
- What type of informal learning environment have you taught in (e.g., zoo, museum, science centre, park, or even in the school playgrounds)?
- When teaching in these environments, do you actually prepare goals?
- Are there any specific Natural Sciences topics or areas that you find particularly well-suited for teaching in these environments? If yes, why?
- What resources or materials have you found helpful when teaching Natural Sciences in informal learning environments?
- When are you teaching in informal learning environments?

- What strategies have you found effective in engaging learners and promote active learning in informal learning environments?
- What activities do you give learners in informal learning environments?
- How do you group learners when teaching in informal learning environments?
- How do you assess and evaluate learners learning and progress in informal learning environments? Are there any specific methods or tools that you find particularly effective?

3.6.2 Interviews

McMillan and Schumacher (2014) define interviews as goal-oriented conversations between a participant and a researcher. There are three types of interviews, namely; structured, semi-structured, and unstructured. Semi-structured interviews were used in this study. According to McMillan and Schumacher (2014), a semi-structured interview enables researchers to ask open-ended questions. Furthermore, in a semi-structured interview, participants' responses are wide open, which provides rich and expressive data (McMillan & Schumacher, 2014). McMillan and Schumacher (2014) explain that semi-structured interviews allow the researcher flexibility in generating data because they provide for probing questions to be raised.

Semi-structured interviews were suitable for this study as they allowed access to participants' attitudes as well as their experiences of teaching in informal learning environments through open-ended questions and follow-up probes. The use of a semi-structured interview allowed the researcher to understand the context in which Natural Science teachers work on, hence understanding their experiences. Interviews enabled the researcher to explore specific aspects of teaching Natural Sciences in informal learning environments that arose during the interview based on participants' responses. Lastly, interviews were suitable for this study as they allowed teachers to share their insights, concerns and suggestions about teaching Natural Sciences in informal learning environments. This allowed the researcher to collect information on participants and to get more understanding of their experiences and attitudes toward teaching Natural Sciences in informal learning environments.

In this study, two participants were interviewed; each participant was interviewed once. All interviews were carried out at the school venues chosen by the participants. The questions for interviews were guided by participants' responses from reflective activities and literature reviews. An audio recorder was used to record each interview, and permission was requested from the participants. Each interview was face-to-face, and it was expected to last for about 30–40 minutes. During the interview, participants were given the freedom to use any language they felt comfortable with. The interviews were transcribed by the researcher in the form of verbatim.

3.6.3 Focus-group discussions

Focus group discussions are used by researchers to gather information for a more in-depth understanding of the topic being investigated by asking a particular group of individuals questions about their experiences, attitudes and beliefs (Creswell & Creswell, 2017). Participants in this data gathering technique interact with one another and exchange thoughts and experiences. Creswell and Creswell (2017) assert that because focus group discussions encourage the acquisition of new knowledge and allow members to communicate with one another and exchange ideas and experiences, individuals may undergo professional transformation for their own advantage. Focus group discussions need to take place in a cordial setting so that participants can express their genuine sentiments (Creswell & Creswell, 2017). Bertram and Christiansen (2014) argue that focus group discussions are relevant when a researcher wants to study how people behave in a particular context. Additionally, focus group discussions allow participants to remember any forgotten details of experiences and release any factors that may discourage participants from disclosing information (Maree, 2016). Furthermore, during focus group discussions a researcher must clarify any misunderstandings; therefore, a researcher must be available during the discussions (Creswell & Creswell, 2017).

Focus group discussion was appropriate for this study as it provided the opportunity to explore deep into teachers' attitudes and experiences and allowed teachers to build on each other's ideas and experiences. Furthermore, the focus group allowed the researcher to use open-ended questions, probes to explore teachers' experiences and attitudes. In

this study, a focus group discussion, which consisted of three participants, was used to investigate teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. The focus group discussion was used to confirm the data collected from the reflective activities and interviews, which guided the focus group discussion. During the discussion, participants were allowed to use any language that they felt comfortable with, and minutes were taken during the discussions to ensure accuracy during data analysis. Furthermore, the focus group discussion was recorded with the participants' permission.

3.7 Data analysis

Bertram and Christiansen (2014) define data analysis as a process that includes field notes, recording, observation, ideas, and experiences about the phenomena being studied. Data analysis involves separating information that has been generated from participants during data collection and separating it into controllable units (Bertram & Christiansen, 2014). This study used a thematic analysis approach to analyse the data. The reflective activity, interviews, and focus-group discussions made it possible to analyse the collected data using a thematic analysis approach. According to Braun and Clarke (2006), thematic analysis involves looking for themes and patterns to identify meaning. Thematic analysis has six phases, namely; familiarisation, generating initial codes, searching for themes, defining, naming themes, and presenting and discussing results (Decarlo, 2018).

- **Familiarisation**- the first step involves reading the data to become familiar with its type and content. The researcher must check for any mistakes in the data recording or any loopholes in the data collected and check the overall credibility of the data (Decarlo, 2018). In this study, the researcher familiarised herself with the data that showed the range of experiences and attitudes expressed by teachers with regards to teaching Natural Sciences in informal learning environments.
- **Generating initial codes**- this involves identifying interesting elements in the data and documenting them while keeping a documented trial of each step. The researcher must also document the main codes found in the data (Decarlo, 2018).

In this study, the researcher started with generating initial codes, which were specific experiences and attitudes.

- **Searching for themes**- this step includes looking for themes in the data and documenting those themes (Decarlo, 2018). In this study, the researcher reviewed the coded data and grouped similar codes to generate initial themes.
- **Defining-** in this step, a researcher must finalise the themes and their names and look for the data that can be analysed under each theme (Decarlo, 2018). In this study, the researcher compared and contracted the data to ensure that the themes accurately represent the teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.
- **Naming themes-** in this step, a researcher must review each theme for its credibility, ensure that no data is missing from being sorted into a theme, and lastly, name the theme with a specific identity (Decarlo, 2018). In this study, the researcher reviewed the coded data and ensured coherence within each theme and assign appropriate names or labels to represent the essence of each theme. These themes capture the different aspects of teachers' experiences and attitudes that merged from the data.
- **Presenting and discussing results**- in this step, the researcher must analyse the results, identify themes, and draw inferences. Data must be documented, and it must be ensured that all important data related to research questions is analysed (Decarlo, 2018). In this study, the data was analysed by looking for themes and patterns in the participants' responses to ensure that the findings were located based on similarities and they answered research questions.

3.8 Trustworthiness

In qualitative research, trustworthiness refers to convincing readers that the study's findings and conclusions are worth considering and that the research maintains a high standard of quality (Bertram & Christiansen, 2014). Furthermore, it measures the level of trustworthy and realistic of the data analysis (Bertram & Christiansen, 2014). Researchers should foster trustworthiness and authenticity by ensuring that genuine, lived experiences are collected and fully analysed. In 1985, Lincoln and Guba defined the concept of

trustworthiness by specifying four criteria in their approach, namely; credibility, transferability, confirmability, and dependability (Bertram & Christiansen, 2014). To ensure trustworthiness, this study followed their approach.

Credibility: ensures that the study findings are rich, robust, and well developed by involving members who review data and perform triangulation (Creswell & Creswell, 2017). In this study, credibility was ensured by applying different data generation methods, such as reflective activities, interviews, and focus group discussions. Furthermore, to ensure credibility, all interviews and focus group discussion were audio-taped and transcribed in a form of verbatim.

Confirmability: refers to the extent of validity that the data can have (Bertram & Christiansen, 2014). To ensure confirmability, all methods and processes utilised to generate and analyse data in this study were fully described to ensure that the results were not influenced by any bias. Furthermore, participants were asked to clarify any slang words used during data collection, and participants direct quotes were used during data presentation to ensure trustworthiness.

Dependability: assures that the research findings are reliable and repeatable in the same setting (Bertram & Christiansen, 2014). Furthermore, it is a method used by a researcher to assess the data generation and processing procedures. To ensure dependability in this study, all reflective activities and focus group discussion were documented, and interviews were audio recorded.

Transferability: refers to the extent to which the research situation can be implemented in another context (Creswell & Creswell, 2017). Creswell and Creswell (2017) further state that transferability refers to the extent to which one situation in a study can be applied to another context. In addition, transferability increases confidence in the study's findings. This study ensured transferability by thoroughly documenting everything, including recording of interviews and focus group discussions.

3.9 Ethical considerations

The University of South Africa's Department of Science and Technology research committee provided ethical clearance and approval to conduct this study (Appendix A). The ethical clearance certificate was used to seek authorisation to collect data from the KwaZulu-Natal Department of Education (appendix B), the Amajuba District, the Circuit Manager (appendix C), school principals (appendix D) and teachers (appendix E). Before the data was collected, all participants were invited through an invitation letter which clearly stated what was expected from them and participants were reminded that their participation in the study was entirely voluntary, and they could withdraw at any time. Participants were given informed consent to sign before the data was collected (Appendix E).

The participants were informed of the study's purpose so that they could comprehend its nature and ensure transparency. Participants were also informed about their rights. To ensure confidentiality and anonymity in this study, pseudonyms were used instead of schools' and participants' names. All dimensions of ethics explained above were guided by Bertram and Christiansen (2014) and Creswell and Creswell (2017).

3.10 Chapter Summary

This chapter has described the research methods that were used to explore teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. In this chapter, the research paradigm and research approach were outlined. In addition, sampling and sample, data collection methods, and data analysis were provided. Furthermore, the chapter described how trustworthiness was ensured and the ethical considerations that were taken in the study.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION

4.1 Introduction

The previous chapter provided the research design and methodology that was used in this study. This chapter intends to present and discuss the data that was generated through the use of reflective activity, semi-structured interviews and focus group discussion. The questions that were used to generate data were derived from the concept of an informal learning environment and the study's conceptual framework. The study involved seven participants from three different schools, which were used to generate data. It is worth noting that different participants were used for each method. Thematic data analysis was used to analyse the data and to generate themes. The study sought to explore the research questions below:

The main research question

What are teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments?

Secondary research questions

1. What are teachers' experiences of teaching Natural Sciences in informal learning environments?

2. What are teachers' attitudes towards teaching Natural Sciences in informal learning environments?

3. What lesson/s can be drawn from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments?

4.2 Themes

In answering the above-mentioned study's research questions, eight themes were generated using deductive thematic analysis, which was guided by the study's conceptual framework. Firstly, codes were generated by analysing the data and scanning specific experiences and attitudes that were shared by teachers. The generated codes were

grouped based on similarities and used to generate themes using the study's conceptual framework. These themes were as follows.

1. Teachers' knowledge about teaching Natural Sciences in informal learning environments.
2. Teachers' reasons for teaching Natural Sciences in informal learning environments.
3. Teachers' goals of teaching Natural Sciences in an informal learning environment.
4. Informal learning environments in the context of Natural Sciences.
5. Teaching and learning activities in informal learning environments.
6. Benefits of informal learning environments in Natural Sciences.
7. Natural Sciences materials and resources for teaching in informal learning environments.
8. Time and location for teaching Natural Sciences in informal learning environments.

4.3 Data presentation and analysis

Since this study used a case study research design, the data was presented using themes. When presenting the data, group teams were used, where group one represents interview group participants, two represents reflective activity group participants and three represents focus group discussion participants. Pseudonyms, namely, Ms. Biyela and Mr. Dube, were used to identify the participants from interviews, whereas the pseudonyms Ms. Gama and Mrs. Vilakazi identified the participants from the reflective activity, and the pseudonyms for the participants from focus group discussions were Ms. Shange, Mr. Mbatha and Mr. Sithole.

4.3.1 Theme 1: Teachers' knowledge about informal learning environments

Interview group team

Interview data showed that teachers believed that informal learning environments occur outside of traditional settings, where learners learn in settings other than the classroom, potentially even at home. They also believed that taking learners for excursions is part of informal learning, as these excursions require learners to go outside of the school

environments. Participants mentioned science expos organised by Sasol to be informal learning, as they provide learners with an opportunity to further their knowledge of the Natural Sciences subject. Furthermore, they explained that learning from television can be considered informal learning as learners bring prior knowledge gained from TV into the classroom, which can influence their formal education. Their responses were as follows:

> Ms. Biyela: "*Informal learning environments does not happen in schools mostly happens outside schools, but I also believe that they are those that are normally done by the Department where the Department organise the excursion and also the science expose that are normally done by Sasol. It does not place the learner exactly in school. Also when learners learn something from TVs that is also informal learning because they come with that prior knowledge at school".*
>
> Mr. Dube: "*Informal learning environments is the teaching and learning environment that occurs outside the classroom maybe at home".*

***Reflective activity group t*eam**

Analysis of the reflective activities showed that teachers believed that informal learning environments are settings where learning occurs outside of formal classrooms, typically without predefined goals or objectives, often occurring in an unplanned manner. They also defined informal learning environments as spaces where learners acquire knowledge without specific instructional guidance, occurring spontaneously as learners go through life. Their responses are shown in Figure 4.1and 4.2 below:

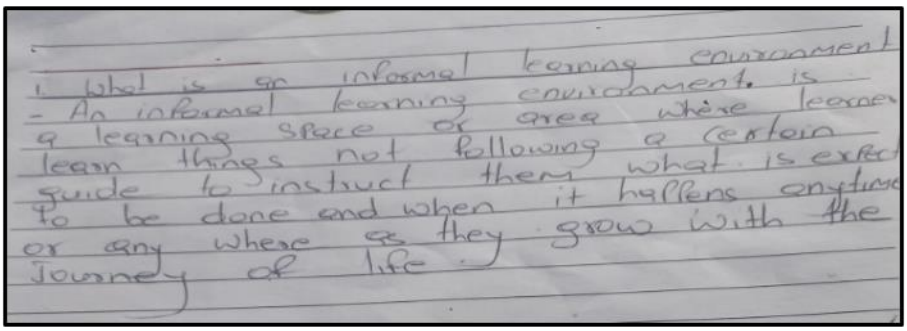

Figure 4.1: Response from Mrs Vilakazi from reflective activity

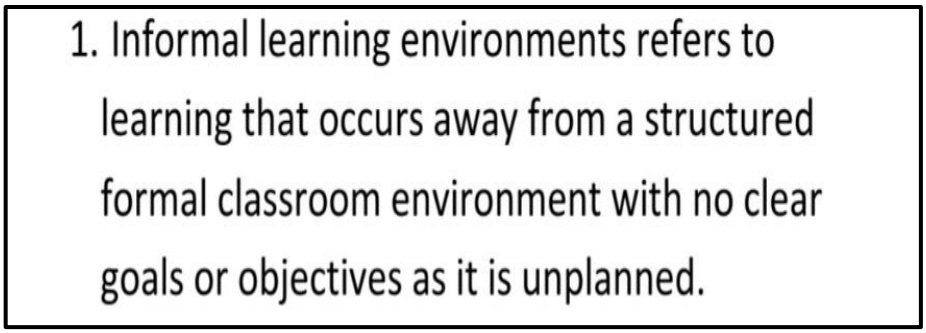

Figure 4.2: Response from Ms. Gama from reflective activity

Focus group discussion team

The data concerning the focus group discussion showed that teachers believed that informal learning environments are settings for teaching and learning that occur outside traditional classrooms, where learners engage in activities such as visiting science exhibitions or museums, as also stated by the interview group. In addition, they noted that informal learning environments lack strict formal assessment where learners have more freedom and often engage in practical activities or experiments outside the classroom that are not recorded for grading purposes. Furthermore, teachers emphasised that the primary goal within informal learning environments appears to be knowledge acquisition and understanding of the subject matter, instead of earning grades or marks. Their discussion was:

> Ms. Shange: *"Informal learning environments are where learners are learning but their learning is not strict like writing formal assessment tasks. If it is informal it means that in the classroom they are free maybe doing practical or they are doing something informal like experiments but those tasks are not recorded. Learners are learning just for knowledge not for getting marks but it for learners to understand science content".*
>
> Mr. Sithole: *"It is where learners are being given an opportunity to be able to handle apparatus and how they are used in order to prepare them for a formal task"*.
>
> Mr. Mbatha: *"Informal learning environments are when we talk about non-traditional learning where we are taking a route outside traditional learning for*

example having a discussion or exhibition. Learners do not formally go to school classrooms as usual, but they sometimes go to science exhibitions or museums. In an environment that exposes learners to science in general compared to formal learning which exposes learners to theory and concepts of science".

4.3.2 Theme 2: Teachers' reasons for teaching Natural Sciences in informal learning environments.

Interview group team

Analysis of the interview revealed that teachers are driven by a specific motivation for teaching in informal learning environments. For example, teachers mentioned that they can be motivated to take learners to informal learning environments to give learners an opportunity to engage with the subject matter in a hands-on and tangible manner. They further stressed that Natural Sciences is not limited to the classroom or laboratory therefore by taking learners to informal learning environments, they empower learners to connect their knowledge to real-world applications. Teachers mentioned that they teach learners in informal environments because learners feel free and motivated and these environments promote active participation and better understanding of the subject content. Thus, two participants provided various reasons as follows:

Ms. Biyela: *"There were times where the topic indicates that we have to go outside and do experiments outside and maybe search for certain animals and different types of seeds and germinate them. I was motivated by the fact that learners get to feel free and understand that science does not end in the classroom or laboratory but it also occurs outside the classroom. Learners enjoy mostly when you take them outside and they get to understand that you are teaching them things that they can touch".*

Mr. Dube: *"I was motivated to teach outside the classroom if learners have to see the plants and touch them and when they are outside, they become relaxed and not being confined because in the classroom they become too serious, not understanding what you are talking about and end up getting bored".*

Reflective activity group team

Analysis of the reflective activities showed that teachers' reasons for teaching in informal learning environments were to help learners understand the content and grasp concepts easily by teaching them about the things that they can take see or touch.

Focus group discussion team

During the focus group discussions, teachers offered a few reasons for teaching Natural Sciences in informal learning environments, with a primary focus on instilling a genuine passion for Natural Sciences in learners. Teachers emphasised that a true understanding and appreciation of science should not be rushed; hence, their reason for teaching Natural Sciences in informal learning environments is to encourage learners to understand that science is doable. They identified a common issue where learners often choose science subjects based on external expectations of success instead of a personal passion. As a result, they choose to teach in informal learning environments to provide learners with authentic and engaging science experiences, increasing learners' interest and enthusiasm for the subject. They went on to say that their reason for teaching in informal learning environments was also to help learners connect science concepts with their real-world experiences, which can help learners retain knowledge. To summarise, their reasons were as follows:

> Mr. Mbatha: *"Yes, I have taught my learners in informal learning environments. My biggest motivation was that I did science out of love and one thing that I have learned in my studies is that you cannot learn science overnight but you must have a passion for science. I have learned that traditional classroom settings do not build that passion in learners but learners tend to choose science subjects because they were told that if they take science subjects they will be successful in life but most of them lack passion for science. That was the reason for taking my learners to informal learning environments to build that passion in my learners and to engage them in a real science".*
>
> Ms. Shange: *"Yes, I have taught my learners in informal learning. My motivation was to make them more focused because in class they get bored and sometimes*

they do not understand the terms we use in Natural Sciences but if you take them out and link those terms with what they can see they start to understand concepts better and you get their attention. In my school, we have a garden so when I teach my learners about different types of leaves. I normally take them outside and show them those leaves, and they understand the content better and enjoy the lesson. If they are doing science outside the classroom, they do not easily forget information and because in the classroom some learners pretend to understand the content".

Mr. Sithole "Yes, my motivation was to help my learners to understand science content better".

4.3.3 Theme 3: Teachers' goals of teaching Natural Sciences in informal learning environments

Interview group team

During the interviews, teachers shared a few goals of teaching Natural Sciences in informal learning environments. These goals included helping learners to link theory with practical experiences in informal learning environments, which increases their interest in sciences and shows them that they deal with science in their daily lives even at home.

Reflective activity team

The data derived from the reflective activities showed that teachers' primary goals of teaching Natural Sciences in informal learning environments were to create an understanding of Natural Sciences among learners and to facilitate their comprehension of scientific concepts. Additionally, they emphasised that their goals were to guide learners in discovering science outside the classroom. Furthermore, they teach in informal learning environments to stimulate curiosity and promote the relevance of science in learners' daily lives. Their responses are shown in Figure 4.3 and 4.4 below:

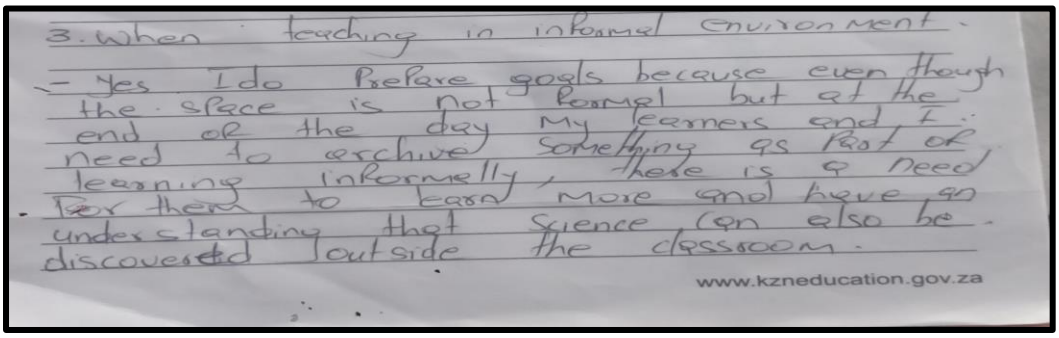
3. When teaching in informal environment.
- Yes I do Prepare goals because even though the space is not formal but at the end of the day My learners and I need to archive something as Part of learning informally, there is a need for them to learn more and have an understanding that Science can also be discovered outside the classroom.
www.kzneducation.gov.za

Figure 4.3: Response from Mrs. Vilakazi from reflective activity

3. Yes. I prepare goals such as developing relationships, improve productivity, increase communication build trust foster creativity, boost moral and enhance engagement.

Figure 4.4: Response from Ms. Gama from reflective activity

Focus group discussion team

During the focus group discussions, participants shared their goals of taking learners into informal learning environments, which included giving learners practical experience, which is known to give learners more understanding of Natural Sciences concepts. They commented that practical experiences deepen learners' understanding of content as they allow learners to see theory in action. Participants felt that when learners learn outside the classroom, science becomes more engaging and enjoyable. They also mentioned that not all learners learn the same, therefore, they acknowledged the importance of accommodating different learning styles, which include learning by doing. They further mentioned that when teaching in informal learning environments, they use ATP (Annual Teaching Plan) to ensure that the learning experience outside the classroom contributes to the overall curriculum. Lastly, they explained that their goal of teaching Natural Sciences in informal learning environments was to create interest in science that goes beyond the classroom by emphasising the importance of connecting science concepts to everyday experience to help learners see that science does not end in the classroom but is all around them. Below is the summary of their responses:

Ms. Shange*: "Taking learners for informal learning does not mean that you are not serious about teaching but it learning on its own because we follow ATP and we also do lesson planning. My goal for taking my learners outside the classroom is to see them understand a particular topic better for doing things practically. For learners to love science and enjoy it and also to give all learners the opportunity to learn because learners do not learn the same way some learners learn better if they are doing things practical".*

Mr. Mbatha*: "The goal is for enjoying science and have fun and also understand that science is doable and interesting and understand concepts outside the classroom".*

Mr. Sithole*: "The goal is to help learners to see the real science near them and for them to love science and see that they are living with science in their daily lives".*

4.3.4 Theme 4: Informal learning environments in the context of Natural Science

Interview group team

During interviews, teachers shared their preferred content to teach in informal learning environments. Their preferred topics to teach in informal learning environments were plants and animals. They mentioned that they choose to teach these topics in informal learning environments because these topics promote understanding of Natural Sciences concepts as learners learn about things that they can touch. Their responses were as follows:

Mr. Dube*: "I teach outside the classroom if learners have to see the plants and touch them".*

Ms. Biyela*: "There were times where the topic indicates that we have to go outside and do experiments outside and maybe search for certain animals and different types of seeds and germinate them. Learners enjoy mostly when you take them outside and they get to understand that you are teaching them things that they can touch".*

Reflective activity team

The reflective activities showed that teachers had specific topics that they considered, particularly well-suited for teaching in informal learning environments. They mentioned topics such as electrical circuits, animal habits, and ecosystems. Teachers explained that they chose to teach these topics in informal learning environments because these topics enable learners to engage directly with their natural surroundings. Furthermore, they emphasised that their selection of these topics was to foster experiential learning and help learners to remember content. Below were their answers:

> Ms. Gama*: "Yes. That is electrical circuit because it allows learners to share information and ideas which will make their investigation more efficient. Learners are able to answer questions more quickly and they get feedback on their work early and stay focused on what matters".*
>
> Mrs. Vilakazi*: "Yes, there are topics that I see or find suitable for teaching in informal space, such as habits of animals and learning more about the ecosystem. Some are those that need learners to investigate where there is a need to do seed germination. I find them well suited as they need learners to be more in touch with the environment itself and do their investigation by real objects not imagination"*

Focus group discussion team

During the focus group discussion, teachers shared their preferred content to teach in informal learning environments, which included topics such as plants and animals, which was similar to the interview group team. They further explained that they also took learners to nearby engineering companies to teach them about electrical circuit topics, which was also similar to the reflective activity group team.

4.3.5 Theme 5: Teaching and learning activities in informal learning environments

Interview group team

During the interview, teachers explained that their teaching activities included explaining the task to learners and monitoring them, as they tend to misbehave during the activities.

They further explained that they gave learners opportunities to do activities on their own to ensure that they acquired the required skills and knowledge.

Reflective activity group team

In the reflective activities, teachers mentioned that they used real objects to facilitate practical learning experiences. They felt that using this approach when teaching in informal learning environments allowed learners to apply concepts in the real world. Teachers mentioned that they used elements such as games, stories, and interesting facts to create a dynamic and attractive learning atmosphere that caters to the diverse needs of their learners. Additionally, they acknowledged the value of simplifying language to help learners understand instructions and explanations. Furthermore, they emphasised that they shift the focus to learners by involving learners in investigations. Participants mentioned the following teaching and learning activities:

> Mrs. Vilakazi: *"I give my learners practical activities as they are the easiest to control even though you may need one group member who will record the results. I also give my learners activities which need learners to be more hands-on on less in writing. I monitor and observe as they do the activity. The teaching strategies that I find effective in informal learning environments also include using ordinary real objects as it allows my learners to apply what we learning into real world experience and using simple language also helps my learners understand content. I also group my learners in small controllable groups".*
>
> Ms. Gama: *"I found that in turns a lesson turn into games and stories, I begin the lesson with interesting facts, it encourages connections that are meaningful and relevant it addresses different learning styles and multiple intelligences. It a plan for a short attention span. You also find a chance to converse with learners instead of talking to them. We maintain proximity and eye contact this offer choices. I give team building activities, games, self-study, they watch videos and investigations".*

Focus group discussion team

During the focus group discussion, teachers shed light on the distinct nature of teaching and learning activities in informal learning environments. They highlighted that their

teaching strategies undergo significant changes, adapting to learners' individual paces and allowing them to take the lead in their learning, instead of relying on direct instructions. They further elaborated on their approach to promoting active participation by encouraging all learners to share their ideas. They felt that promoting peer learning and collaboration with engineers from nearby companies helps learners understand Natural Sciences concepts better. Summarily, their responses were as follows:

> Mr. Mbatha: *"Teaching strategies for informal learning environments are not the same as traditional classroom settings. In informal learning environments, I go with the learners' pace and I let them be the one who directs me. I let all learners participate in a topic and share their ideas before I give them the correct answer. I let them ask more questions and I will answer their questions and let other learners answer the questions. When we go to nearby engineering companies I let the other people such as engineers be the ones who teach my learners instead of me talking. My role is to induce the love for science in my learner and induce curiosity in learners and make them ask questions and I act as a mediator between learners and science content".*
>
> Ms. Shange: *"Strategies change because usually in the classroom learners listen to the teacher, take notes or answer questions but in informal learning environments normally my learners are the one that does the talking and show me things. I only demonstrate and allow them to explore science so that I can see if they understand what they are doing. My role is to deliver content, give instructions, ensure that learners are disciplined at all times during the activity, ensure that all learners are participating and check if they understand the content if they do not understand I re-explain the content or topic. I make sure that they understand what is expected from them and ensure that all materials or apparatus are available and improvise in order to ensure that everything goes well. To check if the environment is safe for learners and I also monitor the whole process".*
>
> Mr. Sithole: *"Once I take learners outside of the classroom the teaching strategy became learner-centred and I allow my learners to drive the lesson. I only give*

instructions and demonstration and give learners a chance to do things on their own".

4.3.6 Theme 6: Benefits of Informal Learning Environments in Natural Science

Interview group team

The results concerning the interview data showed that teachers believed that teaching in informal learning environments is advantageous for both teachers and learners. They mentioned that teaching in informal learning environments empowers teachers to embrace a variety of teaching styles and enhance their pedagogical skills. Additionally, they emphasised that informal learning environments foster personal development and interest in science among teachers. They further stated that informal learning environments help learners to understand science better. Thus, participants mentioned the following benefits:

Mr. Dube: *"Learners get relaxed and understand what you are teaching".*

Ms. Biyela: *"I myself benefit from teaching in informal learning environments because you learn new styles of teaching. Informal learning environments also promote subject integration because while you teach science you get yourself popping out of science into another subject. Even learners who are lost in that subject will start understanding that topic. Informal learning environments also developed me for the love of science".*

Reflective activity group team

In the reflective activities, teachers mentioned a few benefits of teaching in informal learning environments, which included helping learners explore Natural Sciences, thus enhancing their skills and knowledge of the subject. They further explained that when teaching in these environments, it is easy to see if learners have understood the topic and correct any misconceptions.

Focus group discussion team

During the focus group discussions, teachers provided several benefits of informal learning environments. They believed that informal learning environments help learners

focus and feel more at ease compared to the formal classroom. Teachers mentioned that learners feel free and ask questions, which enhances their understanding of Natural Sciences concepts. Teachers felt that informal learning environments not only benefit learners but also benefit teachers, as they get improvements in their teaching strategies. It is worth noting that one participant merely mentioned the benefits of informal learning environments during the discussion, therefore, only two participants shared their experiences. During the group discussion participants highlighted the following benefits:

> Ms. Shange: *"One of the benefits is to get my learners to focus and get their attention. You get more prepared as a teacher because when you take your learners to an informal learning environment you have to be prepared for their questions, and you get more engagement from learners, and you can see if your learners understand the content. In informal learning environments, you can also see if as a teacher you need to change your teaching strategies if learners do not understand".*
>
> Mr. Mbatha: *"Learners understand the content better and enjoy science".*

4.3.7 Theme 7: Natural Sciences materials and resources for teaching in informal learning environments

Interview group team

In the interviews, teachers described the challenges they encountered when teaching Natural Sciences in informal learning environments, particularly due to resource shortages. They highlighted the need to improvise to a significant extent, often having to use their funds to facilitate these educational experiences. Furthermore, they pointed out that schools located in rural areas continue to struggle with resource shortages, which affected the successful implementation of informal learning environments. Their responses can be summarised as follows:

> Ms. Biyela: *"The school is located in a rural area and there are no laboratories wherever when you do an experiment you have to improvise. Sometimes you have to go into your own pocket in order to teach learners. We do not have enough*

resources the only resources that we are provided with are the textbooks. There is a shortage of Science kit equipment. There is a shortage of funds".

Mr. Dube: *"If I want to teach my learners about plants you found out that the environment does not have those plants that I want to teach about. Even if they are around, you find that the place is too far in a way that when you get there the time will be against you. Another challenge is that the school budget is too limited, and the school cannot sponsor trips to informal learning environments such as museums, and science centres and find that for that trip to be successful you need to fundraise which might take longer. Hence funding is a big challenge for those schools that depend on norms and standards of the department because schools do not have resources necessary for teaching".*

Reflective activity group team

In the reflective activities, teachers mentioned that they used various materials and resources, including science dictionaries, YouTube channels and objects such as dried seeds and soil, to effectively teach learners in informal learning environments. Their answers were as follows:

Ms. Gama: *"Resources that I use for teaching in informal learning are textbooks, radio programs, YouTube channels for science teachers and learners, national geographic, science dictionary and science websites for kids, internet. Materials are protective aprons, eye washing stations, emergency shower, safety goggles, protective aprons, fire blankets and fire extinguishers".*

Mrs. Vilakazi: *"I use real objects such as soil and dried seeds* and *general equipment like bottled water for germination".*

Focus group discussion team

During the focus group discussion, participants mentioned that they used resources such as leaves when teaching learners about plants. They further explained that they used science apparatus such as test tubes, beakers, acidic and basic substances.

4.3.8 Theme 8: Time and location for teaching Natural Sciences in informal learning environments.

Interview group team

During the interviews, participants mentioned that they took learners on field trips when they wanted them to make connections with what they were learning in the classroom. They further stated that they took learners to these environments when they wanted them to relate the information that they learnt in the classroom with real-life experiences.

Reflective activity group team

In the reflective activities, teachers explained that they did not adhere to a fixed schedule when teaching in informal learning environments. Instead, they chose to take learners to these environments whenever there was a specific need. They indicated that they utilised locations such as the school grounds during Natural Sciences periods, especially when learners were required to conduct investigations. Additionally, they described taking learners to science centres as a valuable practice, as it exposed them to science experiences. Below are their answers:

> Mrs. Vilakazi: *"During my school period I take my learners to the school field to investigate specific project that requires us to investigate. Sometimes during weekends, we book in a science centre for certain science experiments to help learners get science experience".*
>
> Ms. Gama: *"Anytime and anywhere when there is a need to go outside and explore reality".*

Focus group discussion team

During the focus group discussions, teachers explained that their decision to take their learners into informal learning environments depended on the availability of teaching resources. They mentioned that they often chose to take learners to science exhibitions to expose learners to science experiences instead of direct instructions. Teachers described taking learners to the school playground and occasionally visiting nearby

companies and museums to further enrich learners' understanding of Natural Sciences content. They mentioned that they also used school gardens for teaching learners in informal learning environments. However, it is worth noting that one teacher clarified his preference for classroom teaching, by bringing apparatus into the classroom as needed, instead of taking learners into informal learning environments. Their responses were as follows:

> Mr. Mbatha: *"It depends on the resources I have around me. I used to take my learners to science exhibitions and let them be exposed to real science compared to telling them things. Sometimes, we go to school playgrounds and explore science. I also take my learners to nearby companies that deal with science".*
>
> Ms. Shange: *"Sometimes, I do informal learning environments in the classroom whereby I engage my learners in practical activities. Sometimes I take them to school grounds and garden depending on the topic I am teaching. Sometimes, I take them to the laboratory. I also take them to a nearby museum".*
>
> Mr. Sithole: *"I do not take my learners outside the classroom I only bring apparatus in the classroom and teach them".*

4.4 Discussion

4.4.1 Theme 1: Teachers' knowledge about informal learning environments

The data revealed that teachers understood informal learning environments as any teaching and learning that occurs outside the classroom or school. These findings link with those of Coll and Coll (2018) who defined informal learning environments as environments for learning that do not occur in a classroom or during formal schooling. Participants also mentioned that informal learning environments are unplanned, which was similar to Bell et al.'s (2009) definition of informal learning environments as space for unplanned or organised learning, as it does not have any set objectives for the teaching process.

Teachers believed that in informal learning environments, assessment is not formal or strict, but learners are given a chance to explore science and understand Natural

Sciences content better instead of being given marks. Participants also mentioned that giving learners practical activities and experiments is also considered informal learning, as it prepares learners for formal learning. Furthermore, findings revealed that teachers believed that informal learning environments can be considered as part of lifelong learning, as they prepare learners for real-life experiences as they grow in life. Lastly, teachers mentioned that they use informal learning environments for informal assessment where learners are given a chance to explore science without being formally assessed, which allows learners to be free and understand the content. This was in line with findings from Martin et al. (2016) who mentioned that informal learning is often a lifelong process, continuing beyond formal education and into adulthood. They went on to mention that informal learning environments typically rely on informal methods of assessment, which can be less formal and less standardised than the assessment methods used in formal learning environments.

4.4.2 Theme 2: Teachers' reasons for teaching Natural Sciences in informal learning environments

Teachers provided different reasons for teaching in informal learning environments. They emphasised the importance of enabling learners to directly engage with the subject matter, emphasising the significance of hands-on learning. This perspective aligns with the findings of Gerber et al. (2001), who contend that informal learning environments offer a unique opportunity for learners to gain hands-on experiences and connect their knowledge to real-world applications. Furthermore, Popovic and Lederman (2015) emphasised that informal learning environments excel in promoting teaching through real-world modelling and practical examples, ultimately enhancing the material's relevance. Teachers have noted that learners tend to feel liberated and motivated in informal settings, which fosters active participation and a deeper understanding of the subject matter. These observations were in line with the suggestions made by Rogoff et al. (2016), who propose that such environments enable teachers to support individual interests and initiatives, facilitating comprehension and the long-term retention of new knowledge. They also highlighted the value of social interaction among learners in these

environments, where ideas are exchanged and collaborative problem-solving occurs, leading to a deeper understanding (Rogoff et al., 2016).

The data gathered further showed that teachers are motivated to utilise informal learning environments with the intention of providing learners with authentic and engaging science experiences. This approach fosters genuine interest and enthusiasm for the subject, which aligns with the insights of Denson (2015). Denson asserts that informal learning environments nurture a sense of personal accomplishment among learners, fostering more positive attitudes toward science and increasing self-efficacy. These positive attitudes and self-efficacy are deemed crucial for cultivating intrinsic motivation toward science, which, in turn, can yield long-lasting benefits for learners' academic and career pursuits (Denson, 2015).

4.4.3 Theme 3: **Teachers' goals of teaching Natural Sciences in informal learning environments**

The collected data highlighted that teachers have specific objectives when teaching learners in informal learning environments. However, this was a contradiction to the research, as during the reflective activities, one participant defined informal learning environments as unplanned with no clear goals and objectives. Their foremost goals included facilitating a comprehensive understanding of the subject matter and providing learners with hands-on, experimental learning opportunities. These aims closely align with their broader motivations for teaching in informal settings, where they strive to make science more engaging and enjoyable. Teachers also recognised the diversity in learners' preferences and learning styles, stressing the importance of accommodating these variations.

Their goals of teaching in informal learning environments resonate with the perspective put forth by Popovic and Lederman (2015). They suggested that adopting a more interactive and experiential approach to science education in informal settings can be particularly beneficial for learners who may face challenges in traditional educational settings, ultimately igniting their interest in the subject matter. They went on to mention that taking learners to informal learning environments is a deliberate strategy employed

by teachers to create an inclusive and accommodating learning environment that caters to learners of varying learning abilities.

4.4.4 Theme 4: Informal learning environments in the context of science

Based on the collected data, the content that teachers in informal learning environments depends on the particular topic they are teaching. The lesson that was learned from teachers' experiences was their preference for teaching plant and animal topics in these environments as the majority of teachers mentioned plant and animal topics to be well suited for teaching in informal learning environments. Their reasons for teaching these topics were to give the learners experimental learning where they explained that learners understand the content better and remember content when they learn about things that they can touch and see. Similarly, Walan and Gericke (2019) stated that informal learning environments assist teachers link the theory that they teach learners in the classroom with real-life experiences, which helps learners understand Natural Sciences better and become motivated towards science.

Their reason for focusing on plant and animal topics stemmed from the desire to provide learners with experiential learning opportunities. Teachers emphasised that when learners can interact and observe tangible aspects of Natural Sciences, they not only comprehend the content more effectively but also retain the knowledge. This pedagogical approach resonates with the findings of Walan and Gericke (2019), who asserted that informal learning environments serve as a bridge, connecting theoretical concepts taught in the classroom with real-life experiences while enhancing learners' understanding of science.

4.4.5 Theme 5: Teaching and learning activities in informal learning environments

Based on the collected data, it is evident that teachers preferred to use a learner-centred approach when teaching in informal learning environments. They emphasised that the utilisation of this approach provides learners with hands-on, experimental learning experiences, thereby enhancing their understanding of the subject matter. This learner-centred approach aligns with the current Natural Sciences curriculum, which places

significant emphasis on learner-centred methodologies as a means to foster scientific literacy and comprehension (Department of Basic Education, 2011:8). Furthermore, teachers revealed that when teaching in these environments, learners are actively involved in conducting investigations, performing experiments, and posing questions. This aligns with the findings of De-An et al. (2021); and Gerber et al. (2001), who asserted that when teachers take learners into informal learning environments, they engage learners in practical activities such as experiments, investigations, and research, all of which are integral components of the Natural Sciences curriculum.

Teachers explained that during informal learning environments, they also engage learners in activities that require them to only provide instructions and give learners a chance to carry out the activities themselves while they monitor if learners are effectively carrying out the expected tasks. Additionally, teachers viewed themselves as mediators between learners and Natural Sciences content, offering learners the opportunities to explore scientific concepts. Furthermore, teachers described demonstration-based methods as often employed when visiting informal learning environments, allowing learners to actively participate in investigations, instead of rote memorisation.

4.4.6 Theme 6: Benefits of Informal Learning Environments in Natural Science

Teachers stressed the positive impact of informal learning environments on both teachers and learners. They noted that learners tend to feel more at ease and focused in informal settings, which, in turn, facilitates stronger teacher-learner connections. They emphasised that these environments encourage learners to ask questions freely, fostering a deeper understanding of the content and providing teachers with opportunities to address any misconceptions. They further explained that these environments improve learners' performance and interests in Natural Sciences as learners understand the science content better when they are outside the classroom. This was similar to Lindah (2017), who contended that informal learning environments influence learners' academic achievement and motivate them.

Teachers displayed a positive attitude towards informal learning environments by mentioning that this approach helps them to improve their teaching strategies and

increase their personal development for Natural Science. This aligns with the perspective of Popovic and Lederman (2015), who argue that informal learning environments offer teachers a platform for self-reflection, enabling them to refine their pedagogy and educational philosophies, ultimately contributing to their personal and professional development. The findings illustrated that the teachers believed that these environments cultivate a genuine passion for science among teachers, which is crucial in motivating learners. This was similar to Popovic and Lederman's (2015) submission that when teachers themselves have a deep passion and enjoyment of science, it significantly motivates their learners to excel in the subject. Furthermore, the lesson that was learned from teachers' experiences and attitudes towards teaching Natural Sciences in informal learning was the benefit of informal learning environments to their teaching strategies. Teachers stated that these environments allow them to integrate Natural Sciences with other subjects which helps learners understand content easily.

4.4.7 Theme 7: Natural Sciences materials and resources for teaching in informal learning environments

Findings revealed that when teachers teach in informal learning environments, they utilise a range of materials and resources, including real objects, plants, animals, and soil. They mentioned that their primary motivation behind using these resources is to provide learners with authentic, real-life experiences, a crucial element in effective science education. Furthermore, teachers explained that the choice of resources that they use in informal learning environments is based on the specific activities in which learners will be engaged. However, it is evident from the data that schools located in rural areas continue to struggle with resource and funding challenges.

Teachers highlighted those limited resources affected their ability to successfully implement informal learning environments. This issue aligns with the insights of Falk and Dierking (2016), who note that the shortage of resources can lead to reduced engagement and participation among museum visitors. They went on to say that as many of these schools face financial constraints, it becomes challenging for them to offer high-quality informal learning opportunities. Similarly, Plessis and Mestry (2019) have also recognised the impact of resource availability on teachers' planning and their ability to

involve learners in informal learning environments. They stated that the shortage of resources in schools emerges as a key factor preventing teachers from embracing informal learning approaches. Teachers mentioned that they end up using their own money to expose learners to informal learning environments. This was similar to the findings by Du Plessis and Mestry (2019) who mentioned that in cases where schools lack the necessary resources, teachers are forced to improvise, which poses considerable challenges. One of the lessons that were learned from teachers' experiences was that schools located in rural areas still struggle with resources for teaching and learning.

4.4.8 Theme 8: Time and location for teaching Natural Sciences in informal learning environments

Teachers indicated that there was no rigid schedule for teaching learners in informal learning environments. Instead, the teachers elected to take their learners to such settings when the subject matter being taught required an exploration of science beyond the classroom. Teachers mentioned that they took learners to a variety of locations, including museums, school playgrounds, science centres, and science exhibitions. Their choices aligned with the types of informal learning environments mentioned in the literature, as evidenced by De-An et al. (2021). They pointed out that teachers use places such as science centres, zoos, national parks, and museums to teach learners science effectively. Additionally, teachers mentioned that they often arrange visits to nearby companies and science exhibitions as a strategy to enhance learners' comprehension of the subject matter. However, there was a contradiction in their responses as one participant mentioned that he brings apparatus to the classroom instead of taking learners to informal learning environments. This contradicted their responses of defining informal learning environments as any learning that occurs outside the classroom.

4.5 Chapter Summary

Chapter Four presented findings from Natural Sciences teachers who were currently teaching the Senior Phase. The data that was generated through semi-structured interviews, reflective activities and focus group discussions was presented according to themes which were deducted from the conceptual framework of the study. Findings

outlined that the majority of teachers are taking learners to informal learning environments and have positive attitudes towards informal learning environments. However, their experiences were different as others mentioned that they faced challenges in teaching Natural Sciences in informal learning environments. Teachers mentioned that their reasons for taking learners into informal learning environments are to provide learners with experiential learning and improve their academic performance. Furthermore, they mentioned various locations for informal learning environments which include science centres, school playgrounds, museums, and gardens. The next chapter will outline the study summary, conclusion and some recommendations, which will potentially close gaps that were detected from teachers' experiences and attitudes towards teaching science in informal learning environments.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The previous chapter presented this study's findings by presenting, analysing, and discussing the generated data. In this chapter, the study summary and findings are provided to conclude by relating the findings with the study's conceptual framework and the existing literature to answer the study's research questions. Furthermore, recommendations and limitations were made based on the major findings. Lastly, the conclusion is presented.

5.2 Summary of the study

Chapter 1 delivered the rationale for the study through an explanation of the research title and study purpose. The study's research questions, location, and objectives were provided. Methodology and data-generation methods were briefly explained. Lastly, measures that were taken to ensure trustworthiness and research ethics were briefly explained in this chapter. Chapter 2 explored the literature review that was related to the study. The chapter included the curricular spider web, which was adopted as the study's conceptual framework. In Chapter 3, the research design and data-generation methods used in this study were explained. The chapter also outlined aspects such as sampling strategy, data collection tools, data analysis, and ethical considerations. Chapter 4 presented the findings and discussion using eight themes that merged from the study's conceptual framework, semi-structured interviews, focus group discussions, and reflective activity. In this chapter, a study summary, conclusions, limitations, and recommendations for future research are provided.

5.3 Summary of the major findings

5.3.1 What are teachers' experiences of teaching Natural Sciences in informal learning environments?

Aims and objectives

The findings of this study showed that teachers had certain beliefs when teaching in informal learning environments; for example, they believed that informal learning environments help learners understand content better, thus increasing their achievement in Natural Sciences. This belief was also supported by the literature, which stated that teachers draw on their experiences to select appropriate teaching strategies, content, and activities to help learners achieve the desired curriculum goals (Rice, 2010). Furthermore, teachers acknowledged the benefits of informal learning environments in providing learners with hands-on and experimental learning which allows learners to explore science.

Learning activities

The study's findings revealed that when teaching in informal learning environments, teachers believe that learners should be involved in activities such as investigations, experiments, and posing questions. Their choices of learning activities were aligned with this study's conceptual framework, which stated that in informal learning environments, learners carry out activities such as practical, investigations, and research, which are all part of the Natural Sciences curriculum (De-An et al., 2021). Furthermore, this was supported by the literature, as Lindah (2017) and Walan and Gericke (2019) stated that teachers' experiences with teaching in informal learning environments can significantly influence how they conduct activities in such settings (Melber, 2005). Therefore, the study's outcomes have shown that teachers' experiences of teaching in informal learning environments play an important role in choosing effective learning activities.

Materials and resources

Teachers mentioned that they used different materials and resources when teaching in informal learning environments such as plants, animals, science apparatus, and soil. The findings revealed that teachers in rural areas still encounter challenges related to resource shortages, which might prevent the implementation of informal learning environments. However, it was evident from this study that teachers believed that they had to find alternative ways to involve learners in informal learning environment activities,

such as using their personal funds, to ensure that learners are involved in different activities that will help them understand Natural Sciences. This was similar to Walan and Gericke (2019), who noted that teachers draw upon their experiences to create positive learning environments, even in cases where the school environment does not necessarily support informal learning activities.

Since teachers' experiences significantly influence their choice of activities, professional development programs should focus on enhancing teachers' skills and confidence in informal settings. This could involve workshops or training on how to facilitate hands-on activities effectively. The alignment with the Natural Sciences curriculum implies that educational frameworks should incorporate informal learning principles, ensuring that teachers have the resources and support to implement these activities in various settings.

Location

Teachers mentioned that they taught learners in different informal learning environments such as museums, science centres, school grounds, and science exhibitions depending on the topic being taught. These locations were similar to the study's conceptual framework, which stated that teachers teach learners science by visiting science centres, field trips, national parks, and museums (De-An et al., 2021).

5.3.2 What are teachers' attitudes towards teaching Natural Science in informal learning environments?

Teachers' role

The study's findings showed that teachers had positive attitudes towards teaching Natural Sciences in informal learning environments. Teachers acknowledged the benefit of informal learning environments in allowing them to give learners a chance to explore science while acting as mediators between learners and science content. They further mentioned that their role during informal learning environment activities was to ensure that learners obtain the required skills and knowledge. This was in line with the study's conceptual framework and the existing literature, which states that the role of a teacher

during informal learning environment activities is to explain the activities to learners and observe them while doing the activity. Sonmez and Ozturk (2022) assert that teachers must guide learners and ensure that they obtain the required learning objectives, explore science and relate it to their daily lives. Teachers felt that informal learning environments do not only benefit learners; they also benefit from teaching in these environments, as they have stated they also learn while teaching in these environments. These findings resonate with Popovic and Lederman (2015), who asserted that informal learning environments provide valuable opportunities for teachers to enhance their professional development. These settings also allow teachers to engage in discussions and reflection on their pedagogy and educational philosophies, which can lead to a deeper understanding of their teaching practice (Popovic & Lederman, 2015).

Time

Although teachers shared the positive benefits of teaching Natural Sciences in informal learning environments, they also shared negative attitudes towards allocating time to take their learners to informal learning environments. Some teachers mentioned that they did not take their learners to informal learning environments often; instead, they brought apparatuses into the classroom, which prevented learners from exploring Natural Sciences outside the classroom. The negative attitudes of teachers include not taking learners to these settings showing that they did not adhere to all components of the Natural Sciences CAPS document, which recommends that teachers also use allocated time for informal learning such as practical tasks and investigations. Furthermore, these negative attitudes contrasted with the positive attitudes of taking learners into informal learning environments as it prevents learners from exploring Natural Sciences and understanding Natural Sciences concepts better.

Content

Teachers demonstrated a negatively biased perception regarding the content suitable for teaching in informal learning environments, often believing that such settings were only

useful for topics related to plants and animals. This was rooted in their beliefs and attitudes that teaching these topics in informal learning environments, helps learners understand content better when they learn about things that they can touch and see. These negative attitudes limited their recognition of the broader potential of informal learning spaces for teaching different Natural Sciences topics which also contrasted with their positive attitudes of giving learners a chance to explore Natural Sciences.

The findings revealed that the majority of teachers believed that plant and animal topics were well suited for teaching in informal learning environments. Furthermore, teachers believe that when teaching learners about plants and animals, they are able to show learners that Natural Sciences topics are all around them and they learn about things that see in their daily lives. These resonate with Ince and Costu (2017) who stated that learners must be able to see that science is doable and they learn about things that they can encounter in their daily lives.

Teachers' perceptions that only plant and animal topics are suitable for informal learning restrict the Natural Sciences curriculum. This narrow view may prevent learners from engaging with a wider range of Natural Sciences topics. There is a clear need for teacher training programs to address these biases. Professional development should focus on expanding teachers' understanding of how informal learning environments can be used for diverse topics, enhancing their confidence in utilising these settings.

5.3.3 What lessons can be drawn from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments?

There were few lessons that emerged from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments, which were as follows:

Aims and objectives

The collected responses from Natural Science teachers show that teachers take learners into informal learning environments because it provides experimental and lifelong learning, which can be summarised as follows:

- **Informal learning environments are a lifelong learning process**: The majority of teachers believed that informal learning environments prepare learners for lifelong learning, as they stated that they prepare learners for real-life experiences as they grow. This resonates with Martin et al. (2016), who noted that informal learning environments are a lifelong process that goes beyond formal learning into adulthood. Furthermore, findings revealed that informal learning environments also contribute to teachers' professional development, as they mentioned that they also grow professionally when teaching in these environments. This was in line with the existing literature, which states that teaching in informal learning environments allows teachers to improve their teaching strategies, which is crucial in learners' academic achievement and motivation (Popovic & Lederman, 2015).
- **Experimental learning for better understanding**: The study's findings revealed that teachers acknowledge the impact of informal learning environments in providing learners with hands-on experimental learning that enhances their understanding of the content, thus improving their academic performance. This aligns with the existing literature, which states that learners understand content better when they connect theoretical concepts to real-life experiences (Walan & Gericke, 2019).

Materials and resources

Teachers mentioned that it was difficult to prepare practical activities and experiments at school due to the shortage of resources and funding in schools. This challenge prevented the successful implementation of informal learning environment activities. However, teachers mentioned that they ended up using their own funds when preparing for informal activities. This resonates with this study's conceptual framework and the existing literature, which emphasises that a shortage of resources in schools is one of the reasons why teachers do not involve learners in informal learning environments. According to Du Plessis and Mestry (2019), schools do not have the resources necessary for the implementation of informal learning environments; therefore, teachers need to improvise, which is difficult. The findings align with existing literature, indicating a broader systemic

issue. Future research could further explore innovative solutions and best practices for overcoming resource limitations in informal learning environments.

Content

The study's findings revealed that some teachers only acknowledged plants and animals as topics well suited to teaching in informal learning environments. Therefore, these showed that some teachers have limited knowledge of the different topics that can be taught in these settings. This perception can also prevent them from exploring how these environments can be used to teach different topics to improve learners' academic achievement in all Natural Sciences.

5.4 Limitations of the study

This study used a qualitative approach, and it was limited to only seven participants. Therefore, the findings of this study cannot be applied to all Natural Science teachers in the Amajuba District and across South Africa. However, the findings can provide insight into teachers' experiences and attitudes towards teaching Natural Sciences in the Amajuba District. Furthermore, it is important to note that qualitative research does not seek broader generalisation but aims to gain an understanding of the context and individuals involved. As such, the findings can provide insight for future research on teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. As a teacher in the Amajuba District, I tried to remain unbiased as I interacted with participants whom I worked with under the Amajuba District. To adhere to research ethics, I did not express any views throughout the interview and focus group discussion, therefore, all data generated was from the participants' points of view. Another limitation was that during the focus group discussion one participant felt overwhelmed. The participant was quite in most discussions that required the researcher to ask him question directly in order to get his views.

5.5 Recommendations and future studies

Based on the study's findings, the following recommendations were made:

- Teachers do not have adequate knowledge on the importance of taking their learners into informal learning environments in all Natural Sciences topics. Therefore, it is recommended that subject advisors encourage teachers to incorporate informal learning environments into their teaching regardless of Natural Sciences topic. It is also recommended that during training workshops, teachers must be trained and encouraged to allocate time for teaching in informal learning environments.
- Teachers in rural areas still encounter problems with resource shortages for effective teaching. Therefore, it is recommended that the Department of Basic Education provide schools with adequate teaching and learning resources so that learners in rural areas can receive a quality education.
- It is recommended that teachers also try and improvise to improve their teaching in informal learning environments by fundraising and asking for donations from nearby science companies to overcome the resource challenges that rural schools are facing.
- It is recommended that a similar study be conducted on FET phase teachers, as this current study only focused on Senior Phase teachers.
- Future research should be conducted on teachers' influences on learners' attitudes towards learning Natural Sciences in informal learning environments.
- It is recommended that a similar study be conducted outside the Amajuba District.
- It is recommended that a similar study be conducted using different data generation methods and data analysis strategies.

5.6 Contribution of the Study

This study has provided insight into teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. The study showed that teachers understood informal learning environments as any setting for teaching and learning that occurs outside the classroom. Teachers have shared positive experiences of teaching Natural Sciences in informal learning by emphasising the benefits of informal learning environments for learners' achievement and understanding of the subject. The study has also shown that informal learning environments do not only benefit learners; teachers also

get professional development opportunities, which can motivate other teachers to incorporate informal learning environments in their teaching. Furthermore, the study has shown that teachers have positive attitudes toward teaching Natural Sciences in informal learning environments, which includes helping learners' academic achievement in the subject. This can help subject advisors and curriculum developers to ensure that the Natural Sciences curriculum continues to emphasise the use of informal learning to help learners achieve good marks in science. Lastly, the study has shown that some schools located in rural areas are still facing challenges with a shortage of resources. These findings can help the Department of Basic Education support schools with resource availability to ensure quality education services in rural areas.

5.7 Conclusion

This chapter provided a summary of the study. It answered the research questions about teachers' experiences of teaching Natural Sciences in informal learning environments, teachers' attitudes towards teaching Natural Sciences in informal learning environments, and lessons drawn from teachers' experiences and attitudes when teaching Natural Sciences in informal learning environments. Furthermore, the limitations and recommendations of the study were highlighted.

The research findings indicated that teachers had positive and negative experiences with teaching Natural Sciences in informal learning environments. Teachers highlighted the positive experiences of teaching in informal learning environments, which included helping learners understand content and improving their academic performance in the subject. These positive experiences have shown that learners' performance in science and related subjects can improve if teachers use informal learning environments as one of their teaching strategies. The negative experiences included the lack of resources and funding for effective teaching in informal learning environments. Furthermore, teachers showed positive and negative attitudes towards teaching Natural Sciences in informal learning environments. Teachers acknowledged the benefits of informal learning environments when teaching Natural Sciences which showed a positive attitude. However, teachers showed a negative attitude towards allocating time to teach in informal

learning environments. Lessons drawn from teachers' experiences and attitudes were that teachers found plant and animal topics to be well suited for teaching in informal learning environments while ignoring the use of informal learning environments in other Natural Sciences topics. In conclusion, teachers see informal learning environments as lifelong learning processes.

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APPENDICES

APPENDIX A: ETHICS CLEARANCE

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2023/06/07

Ref: **2023/06/07/61127590/39/AM**
Name: Ms SB Kubheka
Student No.:61127590

Dear Ms SB Kubheka

Decision: Ethics Approval from 2023/06/07 to 2026/06/07

Researcher(s): Name: Ms SB Kubheka
E-mail address: 61127590@mylife.unisa.ac.za
Telephone: 0794576523

Supervisor(s): Name: Dr P Photo
E-mail address: Photop@unisa.ac.za
Telephone: 0124292662

Title of research:

Teachers' experiences and attitudes towards teaching science in informal learning environments. A case study in the Amajuba district.

Qualification: MEd Natural Science Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2023/06/07 to 2026/06/07.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2023/06/07 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.
2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
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3. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
5. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
6. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
7. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
8. No field work activities may continue after the expiry date **2026/06/07**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2023/06/07/61127590/39/AM** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof Mpine Makoe
ACTING EXECUTIVE DEAN
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APPENDIX B: PERMISSION LETTER FROM DBE

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

OFFICE OF THE HEAD OF DEPARTMENT

Private Bag X9137, PIETERMARITZBURG, 3200
Anton Lembede Building, 247 Burger Street, Pietermaritzburg, 3201
Tel: 033 392 1051
Email: Phindile.duma@kzndoe.gov.za

Enquiries: Mrs B.T. Ntuli **Ref.**:2/4/8/7507

Ms Silindile Kubheka
P.O. Box 480
DANNHAUSER
3080

Dear Ms Kubheka

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"TEACHERS' EXPERIENCES AND ATTITUDES TOWARDS TEACHING SCIENCE IN INFORMAL LEARNING ENVIRONMENTS. A CASE STUDY IN THE AMAJUBA DISTRICT.",** in the KwaZulu-Natal Department of Education institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from **28th June 2023 to 31st December 2025**.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Mrs Buyi Ntuli at the contact numbers above.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Mr GN Ngcobo
Head of Department: Education
Date: 28th June 2023

GROWING KWAZULU-NATAL TOGETHER

APPENDIX C: Request for permission to conduct research from the Circuit Manager.

Title: Teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments: A case study in the Amajuba district.

Date: 30 June 2023

The circuit Manager

Amajuba District

KwaZulu-Natal Department of Education

Dear Sir/Madam

I, Silindile Kubheka am conducting research under Dr P Photo supervision who is Department of Science and Technology lecture. I am a master degree candidate at University of South Africa. This study does not involve funding. I am respectfully asking for a permission to utilise the schools that will show interest to participate in the study entitled Teachers' experiences and attitudes toward teaching Natural Sciences in informal learning. A case study in the Amajuba district.

This study aim is to gain an understanding of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Furthermore, the study will also investigate lessons that can be learned from these teachers' experiences and attitudes toward teaching Natural Sciences in informal learning environments.

The reason for selecting your circuit is to obtain this study objectives which is to investigate teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environment in the Amajuba district specifically in the Dannhauser circuit.

Consent of Natural Sciences teachers from the Dannhauser circuit will be requested so that they can take part in this study, before the interview, focus group discussion and reflective activity can commence. All participants will be requested to give permission to use the recording device during the study. This study will select three schools to participate.

This study will benefit all schools in the Dannhauser circuit as well as neighboring schools in the Amajuba district. The study will help science teachers to gain more knowledge about teaching science in informal learning environments and changing their attitudes towards teaching Natural Sciences in informal learning environments.

This study does not involve any potential risk. Confidentiality will be ensured throughout the study by giving schools and participants pseudonyms

Since this study does not involve any funding participants will not receive any form of reimbursement or incentives. Participants will receive study findings upon their request.
For more information regarding the study, please contact me on 079 4576 523 or email silindilekubheka88@gaiml.com. Alternatively, you can contact my supervisor Dr P Photo on 079 539 7066 or email photop@unisa.ac.za
Yours sincerely

_____

Silindile Brightness Kubheka

Researcher

APPENDIX D: Request for permission to conduct research at schools.

Title: Teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments: A case study in the Amajuba district.

Date: 14 July 2023

The Principal

Dear Sir/Madam

I, Silindile Kubheka am conducting research under Dr P Photo supervision who is Department of Science and Technology lecture. I am a master degree candidate at University of South Africa. This study does not involve funding. I am respectfully asking for a permission to utilize the schools that will show interest to participate in the study entitled Teachers' experiences and attitudes toward teaching Natural Sciences in informal learning. A case study in the Amajuba district.

This study aim is to gain an understanding of teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments. Furthermore, the study will also investigate lessons that can be learned from these teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments.

The reason for selecting your school is to obtain this study objectives which is to investigate teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environment in the Amajuba district specifically in the Dannhauser circuit.

Consent of Natural Sciences teachers from the Dannhauser circuit will be requested so that they can take part in this study, before the interview, focus group discussion and reflective activity can commence. All participants will be requested to give permission to use the recording device during the study. This study will select three schools to participate.

This study will benefit all schools in the Dannhauser circuit as well as neighboring schools in the Amajuba district. The study will help science teachers to gain more knowledge about teaching science in informal learning environments and changing their attitudes towards teaching science in informal learning environments.

This study does not involve any potential risk. Confidentiality will be ensured throughout the study by giving schools and participants pseudonyms

Since this study does not involve any funding participants will not receive any form of reimbursement or incentives. Participants will receive study findings upon their request.

For more information regarding the study, please contact me on 079 457 6523 or email silindilekubheka88@gaiml.com. Alternatively, you can contact my supervisor Dr P Photo on 079 539 7066 or email photop@unisa.ac.za

Yours sincerely

_____

Silindile Brightness Kubheka

Researcher

APPENDIX E: Consent letter to teachers

Date: 20 July 2023

Title: Teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environments: A case study in the Amajuba district

DEAR PROSPECTIVE PARTICIPANT

My name is Silindile Brightness Kubheka I am conducting a research and supervised by Dr P Photo, who is a Department of Science and Technology lecture. I am pursuing a master of Education at the University of South Africa. This study does not involve any funding. You are invited to participate in a study entitled Teachers' experiences and attitudes towards teaching science in informal learning environments. A case study in the Amajuba district.

WHAT IS THE PURPOSE OF THE STUDY?

This study is expected to collect important information that could be beneficial to science teachers when teaching science in informal learning environments by possible changing their attitudes towards informal learning environments and reflecting on their experiences about informal learning environments which can help them to improve their teaching. The study will also assist curriculum developers by reviewing the curriculum and promotes more informal learning activities which are known to improve learners' achievements in science. In addition, the study can help in identifying challenges that teachers have when teaching Natural Sciences in informal learning environments.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited because of your interest that you have shown in science education in your school.

I received your contact details from your school principal when I asked about Natural Sciences teachers in her school. Please note that this study has selected seven participants from three different schools.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

The study involves semi-structured interviews, focus groups discussion and reflective activity. You will be interviewed on your knowledge, experience and attitudes about teaching Natural Sciences in informal learning environment, each interview is expected to last for 30-40 minutes. You will discuss about teaching science in informal learning environments with other participants in a group and the discussion is expected to last for an hour. Lastly you will reflect on your experience in teaching science in informal learning environments on your own time.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

This study participant is entirely voluntary and no one is forced to participate. Information. Should you decide to participate in this study please be informed that you will be given consent form to sign and this information sheet will be provided to you to keep. Please feel free to withdraw from this study at any time and without giving a reason. Confidentiality in this study will be ensured.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

This study will benefit all schools in the Dannhauser circuit as well as neighboring schools in the Amajuba district. The study will help Natural Sciences teachers to gain more knowledge about teaching science in informal learning environments and changing their attitudes towards teaching science in informal learning environments. This study can also help in identifying any challenges that teachers have when teaching in informal learning environments.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

There is no negative impact of participating in this study and all activities will be done in school selected by you and all school safety protocols will be followed during activities.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

It is your right to insist that your name must not be recorded and that no one expects the researcher and other study members will know about your participation in this research. You will not be connected to the answers you gave in this research as your name will be not recorded. All participants in this research will be given pseudonym and those names will be used during data presentation, analysis, publications, and conferences. There are people who will review your answers for ensuring that everything was done correctly includes the transcriber and Research Ethics Review Committee members. Other than that, only people working in this study will have access to the records that identify you not unless you give permission for other people to see the records.

You can be assured that no single information generated in this study can be traced to you.

Be advised that other study purposes which includes conferences, report and journal may use your anonymous data. No participants will be identifiable should it happen that the study report is used for publication other than participants who were part of focus group discussions who will know about informal provided during discussion.

Focus group discussions are used by researchers to gather information for a more in-depth understanding of the topic being investigated by asking a particular group of individuals questions about their experiences, attitudes and beliefs. Participants in this data gathering technique interact with one another and exchange thoughts and experiences. As a researcher I will ensure that the information you shared during the focus group discussion cannot be connected to you, please be informed that I cannot guarantee that the information will be treated confidentially buy other group members. However, all participants will be encouraged to keep all information confidentially. For the above mentioned reasons, you are advised to bot share any personally and sensitive information.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

The research will store hard copies answers for a period of five years. Please be advised that the filing/ cupboard cabinet that will be used for storing will be locked at the College of Education. A password protected computer will be used for storing all electronic information. Approval to use the stored data in future will be requested from Research Ethics Review. Shredding of hard copies and permanent deletion of electronic copies from the hard drive using relevant software program will be done.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

In this study no participant will receive any form of reimbursement.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

The Unisa Department of Science Education's Research Ethics Review Committee approved this study in writing. If you want a copy of the approval letter, you can ask the researcher for one.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Silindile Brightness Kubheka on 079 457 6523 or email silindilekubheka88@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Dr P Photo at photop@unisa.ac.za. Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

_____

Silindile Brightness Kubheka

CONSENT/ASSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, _____ (participant name), confirm that the individual requesting my consent to participate in this study informed me of the nature, process, potential benefits, and anticipated inconvenience of participation. I read and understood the study as described in the information sheet. I have got enough chances to ask questions and am ready to participate in the study. I understand that my participation is entirely voluntary, and that I may withdraw at any moment without penalty (if any).

I have been informed that the study findings will be converted into a research report, journal publications and/or conference in future, that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the semi- structured interview, focus group discussion and reflective activity.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print)

_____

_____ _____

Participant Signature Date

Researcher's Name & Surname (please print)

_____

_____ _____

Researcher's signature Date

APPENDIX F: FOCUS GROUP CONSENT TEMPLATE

FOCUS GROUP CONSENT

I_____ agree that Silindile Brightness Kubheka may utilize the information I contribute during the focus group for research purposes. I am aware that the group talks will be digitally recorded, and I consent to these recordings as long as my privacy is maintained. To protect anonymity, I agree not to disclose any information disclosed in group conversations to anybody other than the group participants

Participants' Name (Please print): _____

Participant Signature: _____

Researcher's Name: (Please print): _____

Researcher's Signature: _____

Date: _____

APPENDIX G: REFLECTIVE ACTIVITY SCHEDULE

UNISA university of south africa

REFLECTIVE ACTIVITY TAMPLATE

Full Name_____

This individual interview requires you to reflect on your experiences of teaching science in informal learning environments with the researcher and to voice out your views on the role of informal learning environment in science education. The following questions will guide you to put your views.

1. What are informal learning environments?

---

2. When do you teach in informal learning environment such as zoo, museum, science centre, park or even in the school playgrounds?

---

3. When teaching in these environments, do you actually prepare goals?

---

4. Are there any specific science topics or areas that you find particularly well-suited for teaching in informal learning environments? If yes, why?

---

5. What resources have you found helpful when teaching science in informal learning environments?

---

6. When are you teaching in informal learning environments?

---

7. What strategies have you found effective in engaging learners and promote active learning in informal learning environments?

---

8. What activities do you give learners in informal learning environments?

---

9. How do you group learners when teaching in informal learning environments?

---

10. How do you assess and evaluate learners learning and progress in informal learning environments? Are there any specific methods or tools that you find particularly effective?

APPENDIX H: INTERVIEW SCHEDULE

UNISA university of south africa

INTERVIEW TAMPLATE

Theme: Teachers' experiences and attitudes towards teaching Natural Sciences in informal learning environment: A case study in the Amajuba district.

Section A (Introduction)

1. Before I begin, do you have any questions?

Section B (Educational background and teaching experience)

This section deals with the background information of the participant.

1. Please tell me about your educational background
2. What subjects are you teaching?
3. How long have you been teaching the subject that you are currently teaching?
4. What Grade do you teach?
5. What is your age range?

Section C (Teachers' experiences and attitudes about teaching science in informal learning environments)

1. What is your understanding about informal learning environments?
2. Have you taught in informal learning environments? If yes, what motivated you to teach science in informal learning environments?

3. How does teaching in informal learning environments differ from traditional classroom settings?
4. What specific challenges have you encountered while teaching in informal learning environments?
5. From your own experience of teaching in informal learning environments can you share a successful stories or moments?
6. From your own experience of teaching science in informal environments, what are the benefits of teaching science in these environments?
7. What are your overall attitudes towards teaching science in informal learning environments? Do you found it rewarding or challenging and why?
8. Is there anything you want to share with me which you think it is important about teaching in informal learning environments?

Thank you for your participation

APPENDIX I: FOCUS GROUP SCHEDULE

FOCUS GROUP TAMPLATE

QUESTIONS

These questions will guide the group discussion with the teachers; however, follow up questions will be posed depending on participants' responses.

1. What is your definition of informal learning environments in the context of science?
2. Have you taught in informal learning environments? If yes, what motivated you?
3. What are the goals of teaching science in informal learning environments?
4. In your own opinion, what are the benefits of teaching science in informal learning environments?
5. Where do you take learners for informal learning?
6. How do you adapt your teaching methods or strategies when teaching in informal learning environments?
7. What are your experiences with regards to teaching science in informal learning environments?
8. What are your roles when teaching science in informal learning environment?

APPENDIX J: Ms Biyela interview transcript

Section A (Introduction)

Researcher: Before I begin, do you have any questions?
Ms B: No

Section B (Educational background and teaching experience)

Researcher: Please tell me about your educational background
Ms Biyela: I have a Bed with Maths, Natural Sciences and technology majors. I have started working as a teacher since 2013.

Researcher: What subjects are you teaching?
Ms Biyela: I am teaching Natural Science in grade 7, Maths grade 4-7 and Technology grade 7

Researcher: How long have you been teaching the subject that you are currently teaching?
Ms Biyela: Ever since I came to this school so I will say 10 years.
Researcher: What Grade do you teach?
Ms Biyela: Grade 4-7
Researcher: What is your age range?
Ms Biyela: I am 35 years

Section C (Teachers' experiences and attitudes about teaching science in informal learning environments)

Researcher: What is your understanding about informal learning environments?

Ms Biyela: Informal learning environments doesn't happen in schools mostly happens outside schools, but I also believe that they are those that are normally done by the Department where by the Department organise the excursion and also the science expose that are normally done by Sasol. It doesn't place the learner exactly in school.

Also, when learners learn something from TVs that is also informal learning because they come with that prior knowledge at school.

Researcher: Have you taught in informal learning environments? If yes, what motivated you to teach science in informal learning environments?

Ms Biyela: Yes. There were times where the topic indicates that we have to go outside and do experiments outside and maybe search for certain animals and different types of seeds and germinate them. I was motivated by the fact that learners get to feel free and understand that science doesn't end in the classroom or laboratory but it also occurs outside the classroom. Learners enjoy mostly when you take them outside and they get to understand that you teaching them things that they can touch.

Researcher: How does teaching in informal learning environments differ from traditional classroom settings?

Ms Biyela: It differs a lot. These environments itself produces the good parts of science as learners are able to experiment things on their own. For example, when you teaching learners about different kinds of rocks learners can get a chance to feel them and understand the difference. Learners get relaxed and learn and the same time.

Researcher: What specific challenges have you encountered while teaching in informal learning environments?

Ms Biyela: There are a lot of challenges such as Department policies that guide us as educators and also the discipline itself learners get too excited and never focus. They want to do things and not follow instructions and then you have to monitor the whole process to ensure that it is done correctly. It difficult to monitor large number of learners. Learners' behaviour is a challenge and discipline. The environment that learners are living in is another challenge because they cannot explore everything at homes and science language is another barrier. Parents don't cooperate and some parents are not educated enough to teach learners or help learners at home so learners support is very low. The school is located in rural areas and there are no laboratories wherever when you do an experiment you have to improvise. Sometimes you have to go into your own pocket in order teach learners. We do not have enough resources the only resources that we are

provided with are the textbooks. There is a shorted of science kit equipment. There is a shortage of funds. The workshops that the Department give us as science teachers only take a day and they are not enough for us to teach science successful.

Researcher: From your own experience of teaching in informal learning environments can you share a successful stories or moments?

Ms Biyela: I once took my learners for a trip to a company that produces glass and they have to learn the process of glass production and they learned about different kinds of glasses and recycling. My learners were motivated about the recycling part and learned that glasses can be recycled and where to take glasses for recycling. My learners came back very positive and motivated. I have also took my learners to uShaka marine world where they learned about how animals live in the ecosystem and reproduction systems.

Researcher: From your own experience of teaching science in informal environments, what are the benefits of teaching science in these environments?

Ms Biyela: I myself benefit from teaching in informal learning environments because you learn new styles of teaching. Informal learning environments also promotes subjects' integration because while you teach science learners you get yourself popping out of science into another subject. Even learners that are lost in that subject they will start understanding that topic. Informal learning environments also developed me for the love of science.

Learners become open-minded and to look things in a different way. Learners get to link science and apply knowledge in their daily lives. Leaners become positive and understand science.

Researcher: What is your overall attitude towards teaching science in informal learning environments? Do you found it rewarding or challenging and why?

Ms Biyela: I would say it challenging for rewarding because there are challenges but at the end the rewards are positive because my learners get a chance to do more research and find information themselves and get more understanding of the topic.

Researcher: Is there anything you want to share with me which you think it is important about teaching in informal learning environments?

Ms Biyela: We need more support from the Department of education in order to teach science successfully in rural areas because resources are really challenging and I am hoping that your research will help a lot.

Researcher: Thank you for your participation

Ms Biyela: It is my pleasure

APPENDIX K: Mr Dube interview transcript

Section A (Introduction)

Researcher: Before I begin, do you have any questions?
Mr Dube: No
Researcher: Please tell me about your educational background
Mr Dube: I have Senior primary teacher Diploma and Ace specializing in Maths and Science. I have worked at as a teacher for 24 years and I am now a Departmental Head.

Researcher: What subjects are you teaching?
Mr Dube: I am teaching Maths grade 6, Natural Sciences and Social Sciences grade 7

Researcher: How long have you been teaching the subject that you are currently teaching?
Mr Dube: 13 years
Researcher: What Grade do you teach?
Mr Dube: Grade 6-7
Researcher: What is your age range?
Mr Dube: I am 45 years

Section C (Teachers' experiences and attitudes about teaching science in informal learning environments)

Researcher: What is your understanding about informal learning environments?

Mr Dube: Informal learning environments is the teaching and learning environment that occurs outside the classroom maybe at home.

Researcher: Have you taught in informal learning environments? If yes, what motivated you to teach science in informal learning environments?

Mr Dube: Yes, but not that much only if there are some learners that needs assistance there and there. I was motivated teach outside the classroom if learners have to see the plants and touch them and when they are outside, they become relaxed and not being

confined because in the classroom they become too serious, not understanding what you are talking about and end up getting bored.

Researcher: How does teaching in informal learning environments differ from traditional classroom settings?

Mr Dube: As I have said outside the classroom, they become relaxed and they get actively involved unlike in the classroom they tend to sit down and become too serious and some of them pretend as if they understand what you are saying but when we are outside, they feel as if they are not learning they are just there to see things but at the end they are learning and it becomes too practical and they learn about concrete things.

Researcher: What specific challenges have you encountered while teaching in informal learning environments?

Mr Dube: For example, if I want to teach about plants, you found out that the environment doesn't have those plants that I want to teach about. Even if they are around, you find that the place is too far in a way that when you get there the time will be against you. So informal learning environments needs proper planning.

Researcher: From your own experience of teaching in informal learning environments can you share a successful stories or moments?

Mr Dube: Learners understood what I was teaching better after taking them outside.

Researcher: From your own experience of teaching science in informal environments, what are the benefits of teaching science in these environments?

Mr Dube: Learners get relaxed and understand what you are teaching.

Researcher: What is your overall attitudes towards teaching science in informal learning environments? Do you found it rewarding or challenging and why?

Mr Dube: It is challenging because sometimes you find that maybe you have to take learners to a certain area where they will learn about science you find that maybe parents will not be able to pay for that trip and it becomes a challenge that not all learners will be able to attend. Another challenge is that the school budget is too limited and the school

cannot sponsor such trips and find that for that trip to be successful you need to fundraise which might take longer. Hence funding is a big challenge for those schools that depends on norms and standards of the department.

Researcher: Is there anything you want to share with me which you think it is important about teaching in informal learning environments?

Mr Dube: For now, there's nothing. Maybe later on if I have something. I will contact you.

Researcher: Thank you for your participation.

Mr Dube: Thank you.

APPENDIX L: Focus group discussion transcript

Researcher: What is your definition of informal learning environments in the context of science?

Ms Shange: Informal learning environments is where by learners are learning but their learning is not strict like writing formal assessment task. If it informal it means that in the classroom, they are free maybe doing practical or they are doing something informal like experiments but those tasks are not recorded. Learners are learning just for knowledge not for getting marks but it for learners to understand science content.

Mr Sithole: It where learners are being given an opportunity to be able to handle apparatus and how they are used in order to prepare them for a formal task.

Mr Mbatha: Informal learning environments is where we talk about non-traditional learning where we are taking a route outside traditional learning for an example having a discussion or exhibition. Learners do not formal go to school classroom as usually but they sometimes go to science exhibition or museum. It an environment that exposes learners into science in general compare to formal learning which exposes learners to theory and concepts of science.

Researcher: Have you taught in informal learning environments? If yes, what motivated you?

Mr Mbatha: Yes, I have taught my learners in informal learning environments. My biggest motivation was that I did science out of love and one thing that I have learned in my studies is that you cannot learn science overnight but you must have passion for science. I have learned that traditional classroom settings do not build that passion in learners but learners tend to choose science subjects because they were told that if they take science subjects, they will be successful in life but most they lake passion for science. That was the reason for taking my learners to informal learning environments to build that passion in my learners and to engage them in a real science.

Ms Shange: Yes, I have taught my learners in informal learning. My motivation was to make them more focus because in class they get bored and sometimes they don't understand the terms we use in Natural Science but if you take them out and link those

terms with what they can see they start to understand concepts better and you get their attention. In my school we have garden so when I teach my learners but different leaves I normally take them outside and show them those leaves they understood the content better and enjoy the lesson. If they are doing science outside the classroom they don't easily forget information and because in classroom some learners pretend to understand content.

Mr Sithole: Yes. My motivation was to help my learners to understand science content better.

Researcher: What are the goals of teaching science in informal learning environments?
Ms Shange: Taking learners for informal learning doesn't mean that you are not serious about teaching but it learning on its own because we follow ATP and we also do lesson planning. My goals for taking my learners outside the classroom is to see them understanding a particular topic better for doing this practical. For learners to love science and enjoy it and also to give all learners opportunity to learn because learners do not learn the same way some learners learn better if they are doing things practical.

Mr Mbatha: The goal is for enjoying science and have fun and also understand that science is doable and interesting and understand concepts outside the classroom.

Mr Sithole: The goal is to help learners to see the real science near them and for them to love science and see that they are living with science in their daily lives.

Researcher: In your own opinion, what are the benefits of teaching science in informal learning environments?

Ms Shange: One of the benefits is to get my learners focus and get their attention. You get more prepared as a teacher because when you take your learners to informal learning environment you have to be prepared for their questions and you get more engagement from learners and you can see if your learners understand the content. In informal learning environments you can also see if as a teacher you need to change your teaching strategies if learners do not understand.

Mr Mbatha: Learner understand content better and enjoy science.

Mr Sithole: My colleagues have said it all.

Researcher: Where do you take learners for informal learning?

Mr Mbatha: It depends on the resources I have around me. I usually take my learners for science exhibition and let them be exposed to real science compared to me telling them things. Sometimes we go in school play grounds and explore science. I also take my learners to nearby companies that deals with science.

Ms Shange: Sometimes I do informal learning environments in classroom where by I engage my learners in practical activities. Sometimes I take them to school grounds and garden depending on the topic I am teaching. Sometimes I take them to the laboratory. I also take them to a nearby museum.

Mr Sithole: I do not take my learners outside the classroom I only bring apparatus in the classroom and teach them.

Researcher: How do you adapt your teaching methods or strategies when teaching in informal learning environments?

Mr Mbatha: Teaching strategies for informal learning environments is not the same as traditional classroom settings. In informal learning environments I go with learners' pace and I let them be the one who directs me. I let all learners participate in a topic and share their ideas before I give them the correct answer. I let them ask more questions and I will answer their questions and let other learners answer the questions. When we go to nearby engineering companies, I let the other people such as engineers to be the one who teach my learners instead of me talking.

Ms Shange: Strategies changes because usually in classroom learners listen to the teacher, take notes or answer questions but in informal learning environments normally my learners are the one that does and talking and showing me things. I only demonstrate and allow them to explore science so that I can see if they understand what they are doing.

Mr Sithole: Once I take learners outside of the classroom the teaching strategy became learner-centered and I allow my learners to drive the lesson. I only give instructions and demonstration and give learners a chance to do things on their own

Researcher: What are your experiences with regards to teaching science in informal learning environments?

Ms Shange: Learners misbehave and think they are not learning. Resources are limited in school and you get that not all learners will be able to participate because of the shortage of resources and I end up grouping learners and some learners do not participate and that becomes a challenge because some learners end up not understanding the content. Time allocation for Natural Science in also not enough to take learners for informal learning activities.

Mr Sithole: learners get too excited and misbehave.

Mr Mbatha: Learners do not behave as learners get over excited and end up not focusing. Accountability during informal learning environments as a teacher is too much because you have to be accountable for everything that will happen during the activity. Informal learning environments help learners to become more ambitious about science concept and develop love for science

Researcher: What are your roles when teaching science in informal learning environments?

Ms Shange: My role is to deliver content, give instructions, ensure that learners, to ensure that learners are disciplined at all times during the activity, to ensure that all learners are participating and to check if they understand the content if they don't understand I re-explain the content or topic. I make sure that they understand what is expected from them and ensure that all materials or apparatus are available and improvise in order to ensure that everything goes well. To check if the environment is safe for learners and I also monitor the whole process.

Mr Mbatha: My role is to induce the love for science in my learner and induce curiosity in learners and make them ask questions and I act as a mediator between learners and science content.

Mr Sithole: I agree with what my colleagues have said.

Appendix N: LANGUAGE EDITING CERTIFICATE

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Re: Certificate of Editing

I hereby advise that I edited a research dissertation titled: **"TEACHERS' EXPERIENCES AND ATTITUDES TOWARDS TEACHING NATURAL SCIENCES IN INFORMAL LEARNING ENVIRONMENTS: A CASE STUDY IN THE AMAJUBA DISTRICT"** by **SILINDILE BRIGHTNESS KUBHEKA.** My editorial interventions entailed the following, among other aspects:

- English academic language editing, including grammar, spelling, tenses and subject/verb agreement. Efforts were made to ensure that UK English instead of US English was used consistently in the text. Therefore, verbs such as "organize", "emphasize", "realize" and "behavior" were spelled thus, "organise", "emphasise", "realise" and "behaviour", respectively.
- Style and full reference editing according to the Institution's style guide. Here, I also checked consistency in the formatting of in-text references and the list of references, including checking that all the sources cited in text were duly acknowledged and that all the sources on the list of references appeared in the text. Addressing inconsistencies in the use of font types and sizes throughout the document.

Please note that I have not had sight of the manuscript since editing, with Silindile either accepting or rejecting suggested changes or corrections, as is usual. Unless tampered with prior to your reception, I trust you will find the editing quality in order.

Regards
Dr Moffat Sebola,

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