Integrating local knowledge when mediating learning of food preservation in a Namibian multicultural Grade 6 class

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DECLARATION OF ORIGINALITY

I hereby declare that the work contained in this thesis is my own original work. It has not been previously submitted for a degree at any university. Where I have made use of others' ideas, I have acknowledged them as per the departmental reference guide lines.

Signature:  Date: 06/12/2019

DEDICATION

This thesis is dedicated to my lovely wife, Hashondili Sabina. She motivated me and provided all the necessary support throughout this journey.

ABSTRACT

The challenge posed by multicultural classrooms has been acknowledged in many studies. Some scholars believe that the knowledge learners bring to school from their homes or community forms a basis for the knowledge to be acquired at school. That is, if learners' cultural experiences and/or indigenous knowledge are integrated into teaching of science, learners might make good sense of science. Even though the Namibian National Curriculum has responded well to the calls of recognising and integrating indigenous knowledge during teaching and learning, it has failed to provide guidance on how this should be done. Therefore, there is a need to minimise the gap between the intention of the National Curriculum and the implementation of this intended curriculum at classroom level. It is against this background that this study sought to investigate whether or not learners' conceptions and attitudes are influenced by integrating local or indigenous knowledge when teaching food preservation in a Namibian multicultural classroom context.

Underpinned by an interpretive paradigm, the study took the form of a mixed-method case study approach. It was conducted at an urban combined school in the Oshana region, Namibia. The sample consisted of 29 Grade 6 learners doing Agricultural Science, the grade 6 Agricultural Science teacher and four community members from different cultural groups. The community members were invited to demonstrate how they culturally preserve *mahangu (wheat), fish*, *milk*, and *meat* in their respective cultures. Data were generated using the pre-and post-intervention questionnaires, a group activity, observations (videotaped lessons) and learners' journal reflections. Quantitative data from the pre-and post-intervention questionnaires were analysed deductively and presented in tables and graphs. On the other hand, a thematic approach was used to inductively analyse qualitative data, where Vygotsky's (1978) socio-cultural theory was used as a theoretical lens focusing on *culture, mediation, and social interactions*.

The findings of this study revealed that learners' conceptions, attitudes, and interest shifted positively as a result of the integration of local or indigenous knowledge on food preservation. Additionally, during the presentations by the community members, learners were actively engaged, asking questions and showing interest in learning about other cultures. The study thus recommends that Agricultural Science or science teachers should, where possible, make efforts to integrate local or indigenous knowledge in their multicultural classrooms.

Keywords: Agricultural Science; food preservation; indigenous knowledge; socio-cultural theory

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I would like to thank the Grade 6 Agricultural Science teacher and his learners at Suku (pseudonym) private school for participating in this study. They willingly availed themselves and dedicated their time to this study. To the four community members, it was such a wonderful experience having you as participants in my study. Despite your hectic schedules, you availed yourselves to come and share your experiences and cultural knowledge with us. Thank you for your selflessness and invaluable contributions. I will always treasure this!

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LIST OF ABBREVIATIONS AND/OR ACRONYMS

CFCs	Chlorofluorocarbons
DNEA	Directorate of National Examinations and Assessments
EHDC	Education Higher Degree Committee
IK	Indigenous Knowledge
LCE	Learner Centred Education
MoE	Ministry of Education
NCBE	National Curriculum for Basic Education
SATS	Standardised Achievement Test
STAQ	Simpson-Troosts Attitudes Questionnaire
TIMSS	Trend in International Mathematics and Science Study
QUAL	Qualitative
QUANT	Quantitative
WS	Western Science

CHAPTER ONE: SITUATING THE STUDY

1.1 INTRODUCTION

The main goal of the study was to investigate whether or not learners' conceptions and attitudes are influenced by integrating local or indigenous knowledge when teaching food preservation in a multicultural class. In this chapter, the background of the study is described followed by the statement of the problem and the potential value of the study. A summary of the research goal and theoretical framework are highlighted. The data gathering techniques and definitions of key concepts are provided followed by the thesis outline. The chapter ends with some concluding remarks.

1.2 BACKGROUND OF THE STUDY

The challenge facing the field of science education globally and locally is learners' interest in science, getting learners to take up science and recruiting and retaining them in the field of science (Agunbiade, 2016; Welch, 2010). Science subjects such as Physical Science require abstract thinking since much of what is taught cannot be seen; for example, atoms do not exist somewhere for learners to physically see and feel, instead models are used to explain these aspects (Govender, 2014; Nikodemus, 2017). Hence, this abstract thinking is a challenge to many learners. As a result, some learners prefer to pursue subjects in the arts and social sciences (Zubair & Nasir, 2011).

It was reported by Norwich and Duncan (1990) that learners who had positive attitudes towards learning science were more likely to engage with science subjects in the future. Additionally, Pell and Jarvis (2001) alluded that there is a positive relationship between a positive attitude towards science and achievement in it. In other words, learners with positive attitudes towards science are more likely to perform well, ensuring that they continue with those subjects. Moreover, it was also found that learners who were engaged in cultural socialisation by their parents had better academic achievement scores than learners with parents who did not engage them in these practices (Wang & Huguley, 2012).

The concern is that the decline of learners' interest in science leads to the decline in the number of learners pursuing science in many countries in the world (Zubair & Nasir, 2011). Similar

concerns were also raised by Ortega (2003) who reported that the number of learners studying science was declining as the learners moved up to the higher grades. Thus, Ortega (2003) also anticipated that the percentage of learners who would graduate in the field of science more especially at the doctoral level, might decline.

According to the Trend in International Mathematics and Science Study Report (TIMSS) for 2013 and 2015, South Africa's Grade 4 and 8 learners performed very poorly both in Mathematics and Science (Mullis, Martin, Foy, & Hooper, 2015). For instance, South African learners achieved a mean score of 372 that was significantly lower than the international average, and a ranking of 56 out of 57 participating countries. In addition, South Africa was also ranked lower than Botswana, which obtained an average score of 391 below the international average. Namibia has not yet participated in an international assessment study such as TIMSS.

Instead, in 2009, the Ministry of Education, Directorate of National Examinations and Assessments (DNEA) started running a programme called the Standardised Achievement Test (SATS) which has more or less similar objectives as the TIMSS. SATS is the test administered in Grade 5 and 7 after every two years in both public and private schools in Namibia to measure the standard of English, Mathematics and Science. According to the SATS report, Grade 5 and 7 learners performed poorly in both Mathematics and Science. Since 2010, the learners have performed below 59% (Namibia. Ministry of Education, [MoE], 2016). On average, however, the Grade 5 learners' performance was slightly higher than the Grade 7 learners, an observation which resonated well with Ortega's (2003) study who alluded that learners' interest in science declined as they moved to the higher grades.

The majority of learners who participated in the SATS were in the age range of 14 and 18 respectively. Tytler (2010) argued that for the majority of learners, their life aspirations begin before the age of 14. He further revealed that the critical age at which learners attitude towards science can be influenced is age 8 to 13 or 14. If any attempt is made to engage learners earlier or soon after the age of 14 years, the engagement might be easier, unlike engaging older learners, and their interest in science might be boosted. Thus, it is a concern if this trend of poor performance continues at these ages, since it might have future implications regarding the pursuance of science in higher grades. Furthermore, there might be a decline in the percentage of learners graduating in the field of science more especially at doctoral level, as alluded to by Ortega (2003). There are a number of factors as to why learners' interest in science is declining.

Among them might be the inability of teachers to make science meaningful and interesting to learners (Tytler, 2010). Scholars have argued that poor performance can also be brought about by the gap that exists between what learners know from home and what they are learning at school (Aikenhead & Jegede, 1999; Kibirige & Van Rooyen, 2006; Nikodemus, 2017). When a learner is introduced to a new scientific concept, for instance, a conflict might emerge as there will be two different thoughts (Le Grange, 2007), that is, what the learner knows from home and what he/she is learning at school. Aikenhead and Jegede (1999) refer to this as 'borders crossing'. It is precisely at this moment that a teacher needs to intervene, to mediate the conflict and to negotiate the transition between the two borders.

In light of this, Le Grange (2007) suggested that teachers working in this context should be aware of this interaction and understand the way it could complicate the learning process. Otherwise, if this is not done, learners will not see the link between the two types of knowledge nor the relevance of what they are learning. This might also result in the majority of learners avoiding studying advanced science (Nyika, 2017; Oloruntegbe & Ikpe, 2011) while others end up dropping out of school since their needs are not being addressed (Klein, 2011).

Equally, the shortfall of learners' participation in science education might be caused by the unequal experience in science education as many learners are not taught in their contexts (Hanson, 2004). Similar findings were reported by Govender (2014) who alluded that African learners are taught science and other subjects in westernised classrooms in the absence of or in denial of their cultural and indigenous experiences.

Admittedly, apart from the teaching approaches used, it is also argued by Tsai (2004) that learners' conceptions of learning have a profound influence on learning outcomes or performances. Conception is a mental process which has to do with how a learner perceives or views a subject. In other words, a learner can be provided with all the necessary resources, best teachers and curriculum in the world, but if the psychological aspect (Vygotsky, 1978) of how they view or perceive the subject is not addressed, then good performance might not be realised.

To address this problem, Hanson and Palmer-Johnson (2000) suggested that the shortage and lack of interest of learners in science can be addressed by considering their experiences through a multicultural lens. Concurring, Mavuru and Ramnarain (2017) added that learners' diverse socio-cultural backgrounds should be taken seriously in science classrooms. These scholars believed that the use of a multicultural lens or the understanding of sub-cultures might provide

a set of resources to learners that are important for generating interest and success in science education. It is against this background that in this study I sought to investigate the conceptions and attitudes of learners when local or indigenous knowledge is integrated in science teaching.

1.3 STATEMENT OF THE PROBLEM

Even though the Namibian National Curriculum has responded well to the calls of recognising and integrating local or indigenous knowledge (IK) during teaching and learning, it has failed to provide some guidance on how this should be done. Therefore, there is a need to minimise the gap between the intention of the National Curriculum and the implementation of this intended curriculum at classroom level. This gap may be hopefully be minimised by my research findings on the integration of local or IK when teaching food preservation in a multicultural classroom.

1.4 SIGNIFICANCE OF THE STUDY

Studies on multicultural classrooms are very few, possibly because most of the schools in Namibia are dominated by monoculture. This study might therefore be of significance in many areas. Firstly, this study might create a platform for learners to see and learn from different cultures, on the topic of food preservation in particular. Most cultural practices are practised in rural areas, while most of these learners are staying in urban areas where these cultural practises are sadly hardly practised.

Secondly, exposing learners, particularly those who live in urban areas to these cultural practices might be a great opportunity for passing cultural knowledge from one generation to the other, as suggested by Kibirige and Van Rooyen (2006). Learners will not only learn about their cultures, but they might begin to start valuing and respecting their cultures, and importantly others' cultures too. On top of that, this platform might help learners to get rid of the misconception they have towards their cultural practices, and others' cultures. This will hopefully ultimately change their conceptions and attitudes towards science.

As discussed earlier, research has indicated that many learners are not doing well in science because they are taught in classrooms where their socio-cultural context is absent (Aikenhead & Jegede, 1999; Kibirige & Van Rooyen, 2006; Hanson, 2004; Nikodemus, 2017). Scholars have also called for a culturally responsive curriculum (Banks & Banks, 1995; Ladson-Billing, 1995; Mhakure & Otulaja, 2017; Mukwambo, Ngcoza, & Chikunda, 2014), even though the

majority of the teachers are experiencing challenges in implementing this curriculum (Govender, 2014; Nyika, 2017). The findings of this study might equip science teachers on how to deal with learners from diverse cultures, as well as how to integrate IK in teaching science.

The community members might benefit too in that the research could promote the link between the school and the community. And most importantly, in my view, the involvement of community members in school activities is something which is lacking at the moment. On the same note, the presentation by the community members could help clarify the misconceptions that other community members might have, if there are any, towards other cultures since they are able to compare and contrast the practices with their own culture.

Many schools in Namibia are characterised by mostly one culture, more particularly the schools in the northern part of Namibia. However, recently as development is advancing in all parts of the country, migration of people from one place to the other is very high turning schools into multicultural classrooms. This has become a challenge to many schools, teachers in particular as the majority of them are not trained on how to handle learners from diverse cultures. This study might therefore be a resource for these teachers to gain insight on how to deal with the knowledge that learners from diverse cultures bring into the classroom context.

1.5 THEORETICAL FRAMEWORK

One of the essential components in a research study is the theoretical framework. It grounds the study and guides the research methodology (Nikodemus, 2017). The theoretical framework provides the researcher with concepts, and serves as a reference for explaining phenomena (Mpofu, Otulaja, & Mushaikwa, 2014). The theoretical framework for this study is drawn from Vygotsky's (1978) socio-cultural theory which emphasises that learning takes place in a social context. From Vygotsky's socio-cultural theory, this study focused on *culture, mediation of learning and social interactions*.

1.6 RESEARCH GOAL AND QUESTIONS

1.6.1 Research goal

The main goal of this study was to investigate whether or not learners' conceptions and attitudes are influenced by integrating local or indigenous knowledge when mediating learning of food preservation in a multicultural class.

1.6.2 Research questions

1. What are the Grade 6 learners' conceptions, attitudes, and interest towards science?
2. What local or indigenous knowledge do Grade 6 learners have on the topic of food preservation?
3. How do Grade 6 learners react and respond to the presentations on traditional ways of preserving food made by the community members?
4. How do the community members' presentations on traditional ways of preserving food influence (or not) learners' conceptions and attitudes in a multicultural class?

1.7 DATA GATHERING TECHNIQUES

A variety of data gathering techniques were used to collect data in this study and these were:

- Questionnaires;
- A group activity and brainstorming;
- Observations; and
- Journal reflections.

1.8 DEFINITION OF KEY CONCEPTS

- **Culture:** the set of attitudes, values, beliefs, and behaviours shared by a group of people, and communicated from one generation to the next.
- **Western culture:** the culture of European people and those that have been heavily influenced by European culture.
- **Multicultural:** multiple culture/traditions existing in a single area.

- **Interest:** the willingness of learners to pursue science.
- **Attitude:** refers to the learners' individual positive or negative feelings about science.
- **Conception:** the general view and beliefs that learners hold about science and the integration of IK in science teaching.
- **Indigenous Knowledge:** knowledge of a particular community in the form of practices and beliefs that have been developed and practiced over a long period of time.
- **Social interaction:** the process by which we act and react to those around us.
- **Mediation:** is a negotiation mechanism which is used to facilitate the learning of science. Mediation can be in a form of materials or by a human being.
- **Preservation:** traditional or modern means of keeping food safe from spoilage.

1.9 THESIS OUTLINE

The study was conducted at Suku Private School (pseudonyms), an urban school in the northern part of Namibia, in the Oshana region and consists of the following chapters:

Chapter One: The first chapter of the study outlined the background of the study, the statement of the problem, the significance of the study, the theoretical framework, research goal and questions. The definition of key concepts and the outline of chapters of the study are also provided.

Chapter Two: Chapter Two reviews relevant literature in this study. Firstly, I discuss the expectations of the national curriculum in terms of teaching, science in particular, and the method of teaching, Learner Centred Education (LCE), as well as the challenges associated with learner-centred teaching. Secondly, I discuss the concepts of food preservation, highlighting the possible causes of moving away from traditional ways to modern ways of food preservation. Thirdly, I discuss literature in relation to Indigenous Knowledge, how it is different from Western Science (WS), and its potential for the teaching of science. Fourthly, I discuss the concept culture as well as the challenges experienced in teaching in multicultural classrooms. Finally, I discuss the conceptual and theoretical framework and its significance to the study.

Chapter Three: Chapter Three discusses the methodological design of the study. This chapter details the research paradigm, research method, research site and sampling, data generating

techniques and procedures, data analysis, issues of validity and trustworthiness and lastly ethical considerations.

Chapter Four: Quantitative and qualitative data are presented, analysed and discussed in this chapter. Quantitative data were generated using pre-and post-intervention questionnaires, whereas qualitative data were generated from the group activity.

Chapter 5: In this chapter, qualitative data generated from lesson observations and learners' reflections are presented, analysed and discussed with reference to the theoretical framework and literature.

Chapter 6: This chapter discusses the summary of the findings in relation to the research questions. Thereafter, based on the findings, some recommendations, limitations, areas for future research and the reflections are provided. Finally, a conclusion is provided to this chapter.

1.10 CONCLUDING REMARKS

In this chapter, I introduced the study and described the background of the study which triggered my interest to conduct this research. The statement of the problem, the significance of the study, the research goal and questions of the study were discussed. Lastly, I highlighted the theoretical framework of the study, defined concepts used in the study, and then presented the thesis outline.

In the next chapter, I discuss the literature relevant to the study as well as the conceptual and the theoretical framework that underpins it.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

The main goal of this study was to investigate whether or not learners' conceptions and attitudes are influenced by integrating local or indigenous knowledge (IK) when mediating learning of food preservation in a multicultural class. The study was triggered by the fact that even though the Namibian National Curriculum has responded well to the calls of recognising and integrating IK during teaching and learning, it has failed to provide some guidance on how this should be done.

In the previous chapter, I presented the context of my study. In this chapter, I thus discuss the literature relevant to my study. Firstly, I present the expectations of the Namibian curriculum in terms of teaching focusing on the integration of local or indigenous knowledge. Thereafter, I discuss the concept of food preservation, beginning with the definition, and the types or ways of preserving food both traditionally and modern ways. I also discuss the concept of local or indigenous knowledge, beginning with the definition, the differences between IK and WS, and the significance and implication of integration of IK in science teaching and learning. I then proceed to unpack the concept of multicultural education, beginning with the definition of culture and multicultural, the challenges experienced in teaching in multicultural schools and how teachers could possible structure their teaching in multicultural classrooms. I discuss the two key concepts in this study; conceptions and attitudes towards science, and finally end the chapter with a discussion on socio-cultural theory, my theoretical framework.

2.2 NATIONAL CURRICULUM EXPECTATION

The Namibian National Curriculum for Basic Education (NCBE) is the official policy for teaching, learning and assessment (MoE, NCBE, 2015). This document provides direction for planning, organising and implementation of teaching and learning. The aim is to ensure that there is consistency in the delivery of the curriculum in both government and private schools in Namibia. In addition, the NCBE provides a framework for development of syllabi, learning materials, and textbooks to be used. This document was crafted based on the constitution of the Republic of Namibia, the Namibian Education Act, as well as the Namibian Vision 2030.

Vision 2030 aims to have citizens who are proficient in language, who understand the process of development and environmental issues, and who are healthy and creative. For this vision to be realised, every citizen should at least have a basic understanding of Natural Science. The NCBE thus considers Natural Science as an essential key learning area which transforms societies in Namibia at large. The Natural Science learning areas include Environmental Learning, Environmental Study, Natural Science and Health Education, Life Science, Agriculture Science, Biology, Physics, Chemistry and Physical Science, and Elementary Agriculture which was the focus of my study (MoE, NCBE, 2015). In Natural Science, learners are empowered with scientific knowledge and skills which they can use to improve their living standards in their societies and to sustain the natural resources. This empowerment can be done through various means including teaching approaches.

In terms of teaching, the NCBE recommends the Learner Centred Education (LCE) approach to teaching and learning. LCE is a pedagogical philosophy about teaching which gives learners and demands from them a relatively high level of active control over the content and the process of learning (Schweisfurth, 2015). Taking control of learning helps learners build on their existing knowledge which leads to more effective and sustainable learning. In addition, the notion of taking control of learning also encourages learners to question critically the knowledge they are receiving. This philosophy, LCE, has historical roots that extend back from the time of Socrates, a Greek philosopher who questioned how the child should be educated (Schweisfurth, 2015). Similarly, LCE is also strongly linked to Vygotskian cognitive psychology (Vygotsky, 1978). It is for this reason that I chose Vygotsky's socio-cultural theory as my theoretical framework or lens in this study.

Chisholm and Leyendecker (2008) highlight three aspects of how LCE acknowledges cognitive psychology: 1) Knowledge is not transmitted, it is constructed in the minds of the learners. Learning is a mentally active process, and learning results from personal interpretation of knowledge; 2) Learning is a process in which meaning is developed on the basis of prior knowledge and experience. Prior knowledge and experience are determined by culture and social context. 3) Language influence culture and thinking, and is central to learning and development of higher cognitive processes.

These aspects are in line with literature on science education which indicate that learning science is not a passive activity, but an activity in which learners actively construct their own knowledge through interacting with their existing knowledge, and ideas provided by the

materials, other learners and the teacher (Ottevanger, Van den Akker, & De Feiter, 2007). LCE was adopted as a substitute of the unsustainable teaching approaches which characterised many African education system including Namibia.

Despite Namibia having a learner-cantered curriculum, a learner-centred approach is absent (Chisholm & Leyendecker, 2008). That is, there is a wide gap between the policy and practice. There are a number of factors that might contribute to this gap. These include lack of teaching materials, overloading of the curriculum, as well as a lack of teacher confidence in implementing the approach (Ottevanger et al., 2007). To improve the teaching and learning process, these authors are of the view that provision of resources and teacher support in a form of workshops should be a priority. There should be consistency in all the components of the curriculum. In other words, if the learner-centred approach is at the heart of the curriculum, it should be clear how this approach is reflected in all components of the curriculum, such us instructional materials and assessment.

Moreover, Van den Akker (1998) argues that a learner-centred approach is a formidable challenge to teachers, and that this good idea is bound to fail if there is insufficient support. In developing such support, a specific and detailed guideline of how to implement the learner-centered approach preferably with each topic should be provided.

A study conducted by Nyambe and Wilmot (2012) in Namibia revealed that despite the policy change from teacher-centred approach to learner-centred, it had not affected the broader systemic factors such as the external control on selection of discourses, time tabling and scheduling as manifested by the scheme of work. In order for meaningful transformation of the pedagogy to take place, these authors are of the view that there is a need for a broader perspective that will take into account not only changes in the teaching approach but also changes in broader structural arrangements such as time tabling, sequencing, pacing and authoritarian views regarding syllabus coverage. That is, the NCBE should also provide specific and detailed guidelines more particularly on the inclusion of local or indigenous knowledge.

It is appreciated that the NCBE places an emphasis on the valuing of Indigenous Knowledge (IK) of learners. Klein (2011) defines IK as knowledge of the indigenous people. In the context of this study, IK could be in the form of prior knowledge (Kuhlane, 2011; Roschelle, 1995) that learners bring with them from their homes. The NCBE acknowledges that the rich history

and heritage of Namibians is an important aspect of meaningful learning. It therefore emphasises that teaching and learning should always begin from the wealth of knowledge and experiences that learners gain continuously from families, communities and through interaction with the environment (MoE, NCBE, 2015).

This literally means that teachers should consider the socio-cultural context of learners in the dissemination and evaluation of science curriculum (Mavuru & Ramnarain, 2017; Mukwambo et al., 2014). Ogunniyi (2007) affirms that learners already bring with them science and scientific concepts from their home background that a teacher can take advantage of. This suggests that teachers should plan well in advance, and identify possible learners' prior knowledge on the topics to be presented beforehand. Moreover, it is argued that learners show greater interest in learning if it is related to their socio-cultural setting or context (Klein, 2011; Mavuru & Ramnarain, 2017). Notably, learning becomes effective when learners' cultural resources from diverse cultural backgrounds are harnessed in the teaching and learning scenario (Lemke, 2001).

The NCBE is thus aware of the existence of cultural diversity in Namibian schools. Regarding language, for example, the NCBE states that the mother tongue should be the language of teaching and learning in Grade 1-3 (MoE, NCBE, 2015). In multilingual schools, mother tongue medium classes should be established if there are sufficient learners to constitute a class (*ibid*.). In the case when learners are insufficient to constitute a class, the medium of learning for those learners should be the predominant local language. Additionally, apart from showing awareness of the existence of cultural diversity in Namibian schools, the NCBE has gone further to suggest guidance concerning language usage in multicultural settings.

However, the curriculum, being aware of the existence of multicultural schools in Namibia, and having recommended the consideration of learners' prior knowledge during teaching, seems to not have done justice to the inclusion of local or IK in science classrooms since it does not provide guidance on how IK should be integrated in teaching and learning. It is argued that IK is chiefly unique to a society and can hardly be shared with people from other societies (Nyika, 2017). One wonders then, might this not mount pressure on teachers as they are already struggling with devising ways of motivating and retaining learners' interest in science?

As an attempt to address this, the NCBE has created room for science to be explored from different angles. In Grade 6, science can be explored from the agricultural perspective. The

Grade 6 Elementary Agriculture syllabus within the Natural Science area is aimed at providing a basic scientific and technical background with the hope of producing much needed scientists and agriculturalists for the country. The content in the syllabus is based on the Namibian context, even though themes and topics are on a variety of scales to meet international standards. A syllabus is actually a document which lists topics that need to be covered in each specific grade. Food preservation which is the focus of my study is one the topics in Grade 6 which has the potential to contribute significantly to the economy of our country. As the country is aiming at producing its own agriculturalists, it is equally important to equip them with necessary agricultural skills such as food preservation.

2.3 FOOD PRESERVATION

Human beings are in competition with microbes. Microbes are germs that feed on foods leaving them in an unfavourable condition for human consumption. When an animal is killed, for example, microbes start to feed on the flesh immediately (Slonczewski & Foster, 2009), leaving it spoiled. The spoilage is only observed when the microbes' population density is high (Madigan, Martinko, Stahl, & Clark, 2006). Food such as fruits and vegetables are available in specific seasons and not in others. In some places, there are surplus products of food products and some food can be perishable. Thus, humans developed preservation methods to prevent the growth of microbes and to keep food fresh for a longer time.

Food preservation thus refers to all means aimed at keeping food safe from spoilage over a long period of time. This method has enabled ancient people to no longer have to consume all the kill and harvest immediately, but to keep if for later use (Aluga & Kabwe, 2016). Several traditional methods of food preservation exist. These methods include *sun drying*, *salting*, *chilling*, and *smoking* (Aluga & Kabwe, 2016).

Fermentation is another common cultural method of preserving food. Fermentation is a process "which releases energy from sugar or other organic molecules such as amino acids, organic acids, purines, and pyrimidine" (Tortora, Funken, & Case, 2014, p. 126). However, this process does not require the presence of oxygen to take place. During this process, food substances are modified biochemically by microbes. The waste products of fermentation such as carboxylic acids, ammonia, and alcohol prevent the growth of microbes as they are building up, ensuring that the food stays fresh for much longer.

Culturally, fermentation is well-known for producing and preserving cheese, breads, *Ogi* in Nigeria, *Gari* in Ghana, *Mahewu* in South Africa (Caplice & Fitzgerald, 1999), and *Oshikundu* in Namibia. Cultural methods of preserving foods are considered to be of a premium type (Caplice & Fitzgerald, 1999), because they retain their flavour and aroma characteristics, unlike manufactured products that can lose these characteristics during the preservation process.

The cultural methods of preserving food are, however, declining (Aluga & Kabwe, 2016). This is due to the high demand from the large populations in towns and cities. Thus, the use of traditional methods of supplying food is minimal since they cannot produce and preserve food in large quantities to meet the demands of so many people. The introduction of modern ways of preserving food is however a loss to Africans, because future generations will miss out on this valuable cultural knowledge of food preservation.

The increase in demand of food has necessitated further scientific research into food processing and development of advanced methods of preserving food. The advanced methods of food preservation include both physical and chemical means (Slonczewski & Foster, 2009). Physical means of food preservation include *"dehydration and freeze drying*; *refrigerating and freezing; modifying the atmosphere; pasteurization; canning* and *ionising radiation"* (Slonczewski, & Foster, 2009, p. 608). Chemical means of food preservation on the other hand involves using chemicals to preserve food. These chemicals include acids and salts (Slonczewski & Foster, 2009) which are added to food to prevent the growth of microbes.

Despite these modern ways of food preservation, nurses and doctors still recommend local or indigenous food because some of these processed foods are considered to have harmful effects on human health. This is supported by Mukwambo et al. (2014) who claim that Africans should not give up their African ways of doing things because it might have negative implications in the future. This signifies the value and the quality of our local or indigenous food and practices which most people, particularly the youth, are turning away from. In the next section, I discuss teaching and learning in multicultural classrooms.

2.4 TEACHING AND LEARNING IN MULTICULTURAL CLASSROOMS

This study's focus is on multicultural education and how this affects science teaching and learning. In this section, I unpack the concept "culture", and then discuss multicultural education.

2.4.1 Culture

Culture is a shared way of making sense of experiences, based on a shared history (Jacobson, 1996). Fischer (2009) views culture as collective events or practices that are approximately shared among members of a particular culture. These include artefacts, beliefs, rituals and norms. Culture is passed on through a socialisation process within a specific group.

Culture influences our psychological processes. According to Lehman, Chiu and Schaller (2004, p. 695), "most inquiries into cross-cultural psychological differences are informed by the concept of 'cultural schemas or paradigms' which consist of sets of socially shared practices, norms, values and other mental events that are loosely organised around some common themes". These cultural paradigms guide the construction of meaning making across many domains of social life.

Guild (1994) argues that perception development differs within various ethnic-cultural groups. This invariably translates to why leaners do not see objects or interpret ideas or events in the same way since their meaning is guided by their cultural paradigms. Ignoring culture and the learning style might disadvantage many learners, particularly the nonmainstream learners since they are limited to learn according to the cultural orientation of the teacher or of the learners in majority.

2.4.2 Multicultural education

Multicultural education is reported to have emerged during the civil rights movements of the 1960s and 1970s in the United States of America (Banks, 1989; Davidman, 1997). It grew as a result of the demands by the minority ethnic groups for the recognition and inclusion in the curriculum of the schools, colleges, and universities. Apart from civil right movements, multicultural education has deep roots in the African-American ethnic studies movements initiated by scholars with the aim of challenging the negative image and stereotypes held against African- Americans who were in the mainstream. These scholars were of the view that creating a positive self-image for the African-American was essential to their collective sense of identity and liberation (Banks, 1989; Davidman & Davidman, 1997). The scholars contributed to the development of multicultural education through research.

Multicultural education is a comprehensive school reform process that aims at providing standard education for all learners (Tonbuloglu, Aslan, & Aydin, 2016). This form of education rejects racism and segregation. That is, learners from different cultural backgrounds are afforded the same opportunity to succeed at school. For teachers to deliver in multicultural classes, Tonbuloglu et al. (2016) and Mhakure and Otulaja (2017) suggest that they should employ culturally sensitive strategies and ensure equal opportunities to all the learners.

Cultural sensitivity involves knowing learners' cultures, and how their cultures influence their behaviour in the classroom. For instance, most learners of Chinese descent appear to be restrained about asking questions and engaging in critical discourse in science inquiry as they perceive this to be disrespectful to their teachers (Mavuru & Ramnarain, 2017). This might be true for learners from sub-Saharan Africa as well. Attempts to address these multicultural challenges have been made in certain parts of the world.

For example, in 2014 a conference was held in the Faculty of Philosophy of the University of Cyril and Methodius in Skopje, Macedonia organised by the OSCE mission in cooperation with the Macedonian Civic Education centre and five teachers' training institutions. The conference was aimed at advancing the practice of preparing future education professionals for work in multicultural environments. The conference acknowledged that it was a challenge for teachers working in multicultural environments. However, it had the potential to be a successful practice for every teacher who had been well prepared during their initial education (Atanasoska, Cvetkova, & Trajkovska, 2015).

The conference suggested that teachers could implement multicultural education in the classroom by 1) integrating diverse reading lists that demonstrate the universal human experience across cultures, 2) encouraging community participation and social activism, 3) supplementing the curriculum with current events and new stories outside the textbook, 4) creating multicultural projects that require learners to choose a background outside of their own and to participate in in-service professional development on multicultural education (Atanasoska et al., 2015). These suggestions relate well to this study whose focus is on understanding the conceptions and attitudes of learners when local or IK is used in a multicultural context.

2.5 INDIGENOUS KNOWLEDGE AND SCIENCE

Nyika (2017) defines indigenous knowledge (IK) as a type of knowledge which people gain as they live and work in their communities. It is different and unique from society to society (Kibirige & Van Rooyen, 2006; Mukwambo et al., 2014). It is comprised of cumulative information of practices and beliefs that have been developed over a long period of time and adapted into a local culture. Nyika (2017) elaborates that IK includes cultural values, songs, beliefs, rituals, community laws, proverbs, local languages, agricultural practices, plants and animal species. The community uses this knowledge in their day-to-day decisions concerning agriculture, hunting, nutrition, health, food preparation and governance. Unlike WS, which is learned passively in classrooms and laboratories, IK is experiential (Nyika, 2017). In other words, IK is learned through experience and transmitted from one generation to the other orally or by actions but it is not documented (Kibirige & Van Rooyen, 2006). On the other hand, WS is Eurocentric and it uses the cultural background of the West, mostly from Europe and North America (Mukwambo et al., 2014).

Western Science has manifested itself in many textbooks and educational curriculums of many African countries. This has caused the teaching approach to be dominated by Western ideas and concepts at the expense of integration of IK. Such a situation has caused confusion among African learners since they cannot see the link and the relevance of what they are learning at school (Kibirige & Van Rooyen, 2006). Western Science is so powerful that we often cannot see its effects on us and our environment till much later (Mukwambo et al., 2014). These authors gave an example of the replacement of refrigerants and solvents such as ammonia, sulphur dioxide, and others that are highly toxic to humans, with chlorofluorocarbons (CFCs) in 1928, only to realise later that CFCs are one of the contributors to the depletion of the stratospheric ozone layer.

IK is the first knowledge that a learner acquires or encounters from birth, as the child interacts with the environment and community members immediately after birth. Such first knowledge becomes the foundation of all knowledge that a learner will subsequently gain in the future, including school science. From it, learners see the personal relevance in what they learn and acquire the ability to grasp what is taught to them at school (Nyika, 2017). Through this foundation, learners also get a sense of their world, and become motivated to learn and to take part in the construction of new knowledge (Manzini, 2000).

The foundation of knowledge or IK further helps to harmonise the transition between what the learners know from home and what they are learning at school (Aikenhead & Jegede, 1999). In this way, the knowledge gap between what is taught in the classroom and what happens outside the classroom might be reduced (*ibid.*). Essentially, these scholars posit that IK serves as a bridge between home and school science, and promotes active participation (Manzini, 2000; Sedláček & Sedova, 2017). The inclusion of IK in the mainstream curriculum can provide a teaching and learning scenario that helps bring about common understanding among learners (Mukwambo et al., 2014).

Furthermore, IK promotes cultural conservation as well as cultural revitalisation for indigenous people (Cooks, Alexander, & Dold, 2012). Thus, bringing learners into contact with indigenous people in the process of schooling may help them respect their cultural values and clarify misconceptions about IK (Erinosho, 2013; Klein, 2011). It was also shown in Simasiku's (2017) study conducted in Namibia that some teachers recognised the value of IK, yet putting it into practice was something else.

Despite such positive ideals about IK, there are however still complexities and challenges around its implementation. Most indigenous practices do not have clear science concepts (Mukwambo et al., 2014), yet the Africanisation of the school curriculum requires teachers and learners to attach scientific explanations to indigenous practices to make sense of science, for example, lightning (Webb, 2013). This situation forces learners to revert back to textbooks for explicit explanations. IK is deeply rooted in people's beliefs and some beliefs are based on historical ideas that are hard to change. Thus, these beliefs might act as barriers to learners from these diverse cultures when it comes to accommodating scientific principles and facts (Le Grange, 2007; Mukwambo et al., 2014).

IK is still excluded in the educational curriculum (Kibirige & Van Rooyen, 2006). These authors are of the view that IK is rooted in a particular community and is not easily shared with members from other communities. The studies conducted by Mhakure and Mushaikwa (2014) and Nyika (2017) revealed that some teachers regarded IK as residual, backward and part of a traditional way of life. In addition, they are of the view that IK is for use by uneducated people; hence they feel that integrating IK would maintain the old era and the mentality of people who are not civilised.

For instance, in a study conducted by Webb (2013) in South Africa, a teacher (participant) criticised the inclusion of IK in the school curriculum saying that it is not going to be of much use to learners as they do not understand how that old knowledge will help them in school. Nyika's (2017) study revealed that IK restricted people to a localised environment and cannot be used internationally.

The tendency of putting IK in opposition to WS, as if these two types of knowledge are totally different, is described by Kibirige and Van Rooyen (2006) as a mere misconception. IK is actually embedded in WS (Mukwambo et al., 2014). It is thus understood that these two knowledge systems should be used to complement each other rather than being seen as mutually exclusive and competing (Cronje, de Beer, & Ankiewicz, 2015). That is, IK should be used to enrich, contextualise and make science relevant to the learners. Admittedly, the integration of the two bodies of knowledge will require a change in teaching approaches. This can be done by identifying and designing classroom tasks that bring in elements of IK that connect with the classroom. It also requires identifying the prior knowledge learners possess about the topic under discussion.

2.6 CONCEPTUAL AND THEORETICAL FRAMEWORK

This study is informed by Vygotsky's socio-cultural theory. In this section, I thus discuss my conceptual and theoretical framework informing this study.

2.6.1 Conceptual framework

A conceptual framework is a network of interlinked concepts that together provide the comprehensive understanding of the phenomenon (Jabareen, 2009). The key concepts for this study are conceptions, attitude and interest. I now discuss them below in relation to science.

2.6.1.1 Conceptions towards science

Scholars have defined conception by using multiple words which shows that there is no single definition of conception. Conceptions are the views that learners hold on a subject, how they would describe the subject, and what they believe is required in learning and doing the subject (Atallah, Bryant, & Data, 2010). In literature, the term conception has often been used parallel with beliefs (Pehkonen & Pietila, 2003). Beliefs are individual experiences, or opinions, knowledge or emotions towards a certain aspect (Pehkonen & Pietila, 2003). In the context of

this study, conception is defined as a learner's views, beliefs or ideas about indigenous knowledge, and what sense or meaning it contributes to the learning of science.

Learners' conceptions of a subject might affect the quality of related cognitive activities and learning outcomes, thus affecting their performance in that subject (Atallah et al., 2010). In other words, the performance in science may not only be poor due to learners who have lost interest in the subject or learners not putting sufficient effort in their studies, but it could also be caused by the belief learners possess about the subject. Being in position of identifying the conception of learners towards science might make it easier to address the poor performance in science because the emphasis is only placed on teaching and resources without addressing these psychological challenges, as proposed by Vygotsky (1978).

The educational contexts or curricular programmes where learners are enrolled also play a role in their conceptions of learning science (Tsai, 2004). Most African countries' curricula are based on European culture, that is, they are Eurocentric. In other words, Africans are marketing the culture of the West at the expense of their own culture. Hence, we are developing a perception in our learners that our cultural knowledge is not as valuable when compared to Western culture. Consequentially, learners might not want to be associated with local or indigenous knowledge as revealed by Mhakure and Mushaikwa (2014) in their study conducted in South Africa.

According to Tsai (2004), there are different types of conceptions, and he singled out the conception of learning. The conception of learning is related to learning approaches, which then influence the learning outcome. For example, a study by Dart, Burnett, Purdie, Boulton-Lewis, Campbell and Smith (2000) revealed that learners in Australia who had the conception of emphasising understanding tended to use a deep approach to learning, whereas learners who had the conception of focusing on memorisation were more likely to use surface approaches when learning. Conception is a mental action and this mental action is externally manifested in the form of attitudes.

2.6.1.2 Attitudes and interest towards science

The earliest person to define the concept attitude was an American psychologist Louis Leon Thurstone. Thurstone (1928) described attitude as "the sum total of a man's inclination and feelings, prejudices and bias, preconceived notions, ideas, fears, threats, and conviction about

any specified topic". He later modified his definition stating that attitude was the "effect for or against a psychological object" (Thurstone, 1931, p. 261). Later again, he renounced his definition of attitude stating that it could be more accurately described as "the intensity of positive or negative effect for or against a psychological object" (Thurstone, 1946, p. 39).

The concept attitude has thus been defined differently by different scholars as there is no consensus reached yet on the meaning of attitude because it is regarded as a multi-faceted construct (Anwer, Iqbal, & Harrison, 2012). By analysing different studies, they have revealed a complex picture of the way the concept attitude is used. Oppenheim (1992) for instance, posited that the definition of attitude has a long and complex history. This is confirmed by Ramsden (1998) who established that in literature, attitude has been used interchangeably with interest and motivation. Other associated terms that were also encountered through reviewing literatures are views, beliefs, images, values and personality characteristic (*ibid*.). Ramsden (1998) further indicated that where definitions, interpretation and explanations are given, the meaning of these concepts, more especially attitude and interest, seem to overlap. Concurring, Sheldrake, Mujtaba and Reiss (2017) also used the concept interest to define attitude.

Others who conducted studies on attitude were Salta and Tzougraki (2004), and Adolphe (2002). Salta and Tzougraki (2004) defined attitude as the tendency to think, feel or act positively or negatively towards objects in the environment. In their article, Papanastasiou and Papanastasiou (2004) defined attitude as a concept which represents the emotional orientation of an individual to respond favourably or unfavourably to things, people, places, events, or ideas. Thus, when a learner says, "*I like science*" or "*I love science*", it signifies an attitude. Based on that, Adolphe (2002) concluded that attitude is a non-observable psychological entity that can only be deduced from a manifested behaviour. These definitions resonate well with Anwer et al. (2012) who argue that researchers are yet to agree on the mutual definition of attitude, even though Osborne, Simon and Collins (2003) have raised concerns that the concept attitude is somewhat nebulous, poorly articulated and not well understood by many in terms of science.

Research has shown that attitude is an important component of science education (Anwer et al., 2012; Osborne et al., 2003; Papanastasiou & Papanastasiou, 2004). Even though many studies concerning learners' attitudes towards science have been carried out, little progress has been done to develop positive attitudes towards science among learners. This is evident in literature which indicates that the number of learners studying science is declining as the grade

level increases (Ortega, 2003; Osborne et al., 2003). On the same note, Ortega (2003) has also raised a concern about the decline in science interest, and anticipated that the percentage of learners graduating in the field of science more especially at the doctoral level, might decline.

Learners' interest and attitude towards science are established mostly at primary school level, or before learners enter secondary school (DeWitt, Archer, Osborne, Dillon, Willis, & Wong, 2011; Turner & Ireson, 2010). By the eighth grade, learners who demonstrated and showed interest in science and science related subjects have been found to be more likely to graduate with at least a four year undergraduate degree in science than their peers who did not express an interest in science (Tai, Liu, Maltese & Fan, 2006). In other words, as learners are progressing through school, their level of interest dictates what to pursue in the future.

Liu, Hsieh, Cho and Schallert (2006) posited that learners with positive attitudes towards science are more likely to maintain science achievement levels even if they feel less capable of doing so than their peers without positive attitudes. Thus, if a learner shows less interest or a negative attitude towards science, this learner might hardly take up science, perform in science, or take up a science related career in the future. Worth noting is that disinterest in science leads to a negative attitude towards science. Therefore, it is important as suggested by Turner and Ireson (2010) to address this issue in order to avoid future effects that may come if the matter is not addressed.

Newell, Tharp, Monero and Zientek (2015) singled out that emphasis should be put on identifying approaches which increase young learners' positive attitudes towards science, and in understanding aspects of these attitudes mostly closely related to positive learners' achievement levels. Improving learners' attitudes towards science potentially could result in cumulative positive effects in which learners will feel motivated to enter into degree programmes in science related fields. More importantly they will be able to adapt to the challenging high school science classes, pursuing a high level of performance that, for example will best prepare them to succeed academically in science (*ibid.*).

Attitude impacts not only on learners' participation and interest but also on their performance in science (Osborne et al., 2003). Papanastasiou and Papanastasiou (2004) confirmed that there is a high correlation between a positive attitude towards science and achievement in science. Consistent findings were also presented by Mettas, Karmiotis and Christoforou (2006) whose study analysed data from the Third International Mathematics and Science Study (TIMSS) for

13-year-olds in Cyprus, and found a significant positive association between students' science self-beliefs and attitudes, and their TIMSS science outcomes. Ozel, Caglak and Erdogan (2013) discovered a mix of outcomes when assessing the impact of student affective factors such as interest in science, on students' scores in an analysis of the 2006 Program for International Student Assessment (PISA) data. Their results suggested that interest had a positive, but weak correlation with science outcomes on the assessment, while other aspects of affect had negative or negligible correlations.

Learners' attitude towards science is influenced by various factors including the teaching approach, school climate, level of motivation and inspiration, and parental influence (Papanastasiou & Papanastasiou, 2004). According to Osborne et al. (2003), student motivation, student self-concept, peer attitudes, classroom environment, perception of school science, and the difficulty of science, determines learners' attitude towards science. Some of the constructs above form part of the Simpson-Troosts Attitude Questionnaire (STAQ) developed by Simpson and Troost (1982), and revised by Owen et al. (2008). In addition, Howie (2004) noted that learners' socio-economic status, English usage in the classroom, learners' perceptions of the importance of science, amongst others, are also some of the factors which influence learners' attitude towards science.

Manzini (2000) reported that many learners in South Africa are not performing well in science. He is of the view that this might be caused by the fact that learners are taught from a European perspective which side-lines the African perspective. He believed that teaching African learners from the Eurocentric perspective created the challenge of contending with science which is completely foreign to learners' worldview and culture. Similar sentiments were also echoed by Le Grange (200) and Mukwambo et al. (2017). Additionally, it might create confusion since there would be a contradiction between what they were learning at school to what they were experiencing at home, a situation which Tobin (1996) described as 'symbolic violence'. Symbolic violence is described by Ogunniyi (1997) as feeling misplaced, failing to find reliable cultural support and not asking questions in class due to the fear of being ridiculed. The lack of cultural support resulted in learners suffering from an inferiority complex, guilt, shame, feeling useless and viewing science as a strange subject (Manzini, 2000).

Klein (2010) is of the view that learners show great interest in learning if it is related to their sociocultural setting. This is evident in Manzini's (2000) study which revealed that learners showed negative attitudes towards science before the study. However, after a series of lessons

that integrated IK or related to their contexts, learners where observed participating actively, volunteering to help with whatever was done during lessons and suggesting various ways in which things can be done. Additionally, learners also showed a great deal of mental involvement in lessons (Manzini, 2000). This was also echoed by Vygotsky's (1978) socio-cultural theory.

2.6.2 Theoretical framework

A theoretical framework is the explanatory tool which enables the researcher to understand as well as explain, the verbal and non-verbal interactions among the participants in the study (Okeke, 2014). The theoretical framework facilitates the entire process of knowledge generation from the literature review until the process is completed. The theory provides concepts that can be used to understand the issues, processes and social development. Additionally, it can also provide the analytical concepts and the language to use when doing research as well as when writing a report (Okeke, 2014).

In this study, Vygotsky's (1978) socio-cultural theory was used to provide explanatory tools as alluded to by Okeke (2014). From the socio-cultural theory, the study focussed on the concepts of *culture, mediation of learning* and *social interactions*.

In his seminal work, Vygotsky emphasised the importance of culture, believing that culture provided tools for thinking and learning. To Vygotsky, all high-order mental processes such as reasoning and problem solving are mediated by psychological tools such as signs, symbols and language. These psychological tools manifest culture. For example, the language of a certain tribe says more about their culture, and it is through language that we are able to identify the culture of an individual. Our way of thinking is informed by cultural paradigms which guide the construction of meaning (Lehman et al., 2004). This means that the learners' interpretation of issues are based on their cultural experiences. The concept of culture in this study therefore provided a lens for understanding learners' interpretations. In addition, Guild (1994) argued that perception development differs within various ethnic-cultural groups. In the context of a multicultural class, more especially classes that are dominated by one culture, learners in the minority group are disadvantaged since they are limited to learn according to the cultural orientation of the dominating group or of the teacher. Therefore, the concept of culture in this study created the platform for the integration of the more knowledgeable people from the minority cultures in the classroom.

Vygotsky (1978) believed that every function in a child's cultural development appears twice, first on their social level and later on their individual level; first between people (interpsychological) and then inside the child (intrapsychological). In other words, as learners are engaged in activities with other learners, parents and teachers, they learn new things. Later they (learners) internalise this knowledge and it becomes part of their cognitive development.

Vygotsky formulated the idea of an instrumental act. This is where a person uses a tool to facilitate the achievement of a certain goal. The tool is said to mediate this action because the person is acting through the tool. In the context of learning, there are various tools that Vygotsky believed mediate learning. This included language, and cultural artefacts. In the Namibian context, the majority of teachers prefer using their mother tongue to mediate learning since it is much easier to explain things.

In this study, community members who demonstrated how to preserve food culturally did it in their mother tongue for mediation purposes. In addition, they also used cultural artefacts to facilitate their demonstrations. Therefore, the mediation lens was used to understand how language (mother tongue) mediated learning, in addition to the artefacts that were used as learning aids during the presentations.

In the context of this study, a classroom is a social unit which consists of learners, the teacher and community members who did the practical demonstrations on food preservation. As learners interact socially, they may learn from one another. Vygotsky believed that learners learn easily when they are interacting with their peers because they feel free to ask or challenge their peers unlike when the interaction is between them and an older person. In the context of this study, the concept of social interaction provided a lens in interpreting the interaction between the community members and learners, or between the learners themselves. Additionally, the group activity was used to collect data, where the concept of social interactions helped in understanding why learners freely talked in their groups, unlike when they are with the teacher or community members.

2.7 CONCLUDING REMARKS

In this chapter, I discussed literature relevant to my study. I began by discussing the Namibian National Curriculum in relation to the integration of local knowledge or IK. I then unpacked the concepts of food preservation, followed by multicultural education, the challenges of

teaching in multicultural classrooms, and then a detailed discussion of local or indigenous knowledge was provided. Lastly, I discussed the conceptual, as well as the theoretical framework informing my study.

In the next chapter, I discuss the research design and methodology underpinning this study.

CHAPTER THREE:RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, I discussed the literature and the conceptual and theoretical framework relevant to this study whose main goal was to investigate whether or not learners' conceptions and attitudes are influenced by integrating local or indigenous knowledge (IK) when mediating learning of food preservation in a multicultural class. In this chapter, I thus describe the methodological framework which guided the research processes of the study. I begin by discussing the interpretive paradigm, followed by the mixed-method approach employed in this study. Thereafter, I discuss the research site where the study was conducted, the research participants and how they were selected, the data generating techniques and the analysis approach to both the quantitative and qualitative data. I then end the chapter with a discussion on validity, trustworthiness and research ethics.

3.2 RESEARCH PARADIGM

The concept 'paradigm' was derived from the work of influential philosopher Thomas Kuhn in the early 1970s (Coe, 2017). Coe (2017) posits that the term paradigm is used to describe a particular way of seeing the world. Similarly, Bertram and Christiansen (2015) define a paradigm as a representation of a particular worldview which defines for the researcher what is acceptable in research and how it should be done. Additionally, a paradigm determines the type of questions to ask, the focus of the investigation, and how to collect and interpret data.

Educational research centres around three key paradigms: the post-positivism, the interpretivism and the critical paradigm (Bertram & Christiansen, 2015). These authors posit that post-positivism works with scientific methods both in social and natural science. The post-positivist researcher describes, controls and predicts how the natural and social world works. They assume that there is one truth about natural and social events, but that we can never come to know it completely. We can however come closer to the truth by means of research questions.

In contrast to post-positivism, interpretivism describes and tries to understand how people make sense of their world, and how they make meaning of a particular action (Bertram & Christiansen, 2015). The purpose is to develop greater insight into how people make sense of the contexts in which they live and work. Unlike post-positivists who believe that one can approximate the truth, the interpretivists believe that there is no reality or truth about the social world, but rather sets of realities or truths which are historical, local, specific, and non-generalisable. In other words, events and situations can be interpreted in many ways (Bertram & Christiansen, 2015).

The critical paradigm on the other hand challenges both the post-positivist and interpretivist paradigm. The researcher working within this paradigm is of the view that the world is characterised by unequal power relations. Some people have power while others are oppressed. Hence, our understanding of the world is informed by our own values and positions in society. A critical researcher therefore critiques the status quo to transform society by addressing those imbalances within society (Bertram & Christiansen, 2015).

In this study however, an interpretive paradigm was used as a lens to understand learners' conceptions and attitudes when local or indigenous knowledge is integrated when teaching science in a multicultural class.

3.3 RESEARCH METHODS

This study was a mixed-method case study. A mixed-method study combines characteristics of both a quantitative and qualitative approach to research in one study (McMillan & Schumacher, 2010). A quantitative approach is a method of using measurements and numbers to formulate and test ideas (Winterbottom, 2013). That is, it usually involves summarising numerical data or using them to find differences and patterns between sets of numbers. This approach employs survey questionnaires as a data collecting technique. Even though questionnaires are also used in qualitative research, they differ in their design in the sense that they generate mostly numerical data.

On the other hand, a qualitative approach is associated with many names such as field research, naturalistic, ecological, and constructivist (McMillan & Schumacher, 2010). However, educational researchers use the term qualitative. A qualitative approach is an approach whereby a researcher learns more from the participants through exploration (Creswell, 2014). For

instance, this study explored in-depth their conceptions, attitudes and interests. Hence, the data generated were largely narrative and textual data. In the context of this study, the data generating techniques for the qualitative data were lesson observation, and journal reflections. The combination of the characteristics of these two approaches is what is called a mixed-method approach.

Mixed-method is regarded as the best approach in research as it provides sufficient answers that meet the goals or purpose of a study. A mixed-method researcher examines the phenomenon from different angles using different methods in order to obtain a more reliable and authentic view which could hardly be achieved when using one method (Warwick & Chaplain, 2013). In this study, the mixed-method approach allowed me to determine the conceptions, attitudes, and interests of a sample of learners (29), at the same time allowing me to find out why their conceptions, attitudes, and interests were as such. In other words, qualitative data were used to explain and support quantitative data by using direct extracts from group activities and journal reflection. It took the form of a case study (Cohen, Manion, & Morrison, 2011).

A case study is defined by Robson (2003) "as a strategy for doing research which involves an empirical investigation of a particular phenomenon within its real life context using multiple sources of evidence" (p. 178). Demetriou (2013) defines a case study as a systematic approach to look at events, collect data, analyse information and report the findings, with the end goal of describing the case under investigation fully and as accurately as possible. In other words, a case study focuses on specific aspects or is context bounded (Day Ashley, 2013). The case study explores the context or the phenomenon and describes it in more detail. In addition, Yin (2009) suggests that case studies have a particular ability to answer the 'why' and 'how' research questions rather than simply the 'what' questions. Therefore, they have the potential to evaluate or explain why a particular phenomenon did or did not work.

In addition to giving a clear understanding of why a phenomenon happens, a case study also reveals to the researcher what might require greater scrutiny in the future (Demetriou, 2013). Case studies are however criticised for limitations in validity and the fact that they cannot be generalised due to not being representative of an entire group. These claims are however dismissed by Yin (2009) who suggests that validity can be established through using multiple sources of data collection methods, establishing a chain of evidence, as well as by having the report reviewed by an expert. Additionally, validity can be established by providing thick

description, and enough details so that the reader can judge (Bertram & Christiansen, 2015). For example, in a case study that Griffiths (2000) conducted at a British secondary school, he argued that his findings could be generalised because it showed *typicality* (conducted with learners and at a school similar to others), *detailed description*, and *multisite research.*

Yin (2009) further suggests that the research method used should align with the nature of the specific research questions. For instance, my research question 1 in this study was about determining learners' conceptions, attitudes and interest towards science. A quantitative data collecting instrument (pre-and post-intervention questionnaire) was used to gather such data. Research question 2 aimed at determining learners' prior knowledge on the topic of food preservation and qualitative data were collected using a group activity. Research question 3 aimed at finding learners' responses and reactions to the presentations on traditional ways of preserving food made by the expert community members, whereas research question 4 focussed on finding how the presentations on traditional ways of preserving food influenced (or not) learners' conceptions and attitudes in a multicultural class. Additionally, data responding to research questions 3 and 4 were generated from lesson observations and learners' reflections. To get the true sense of learners' conceptions and attitudes after the integration of local or IK in teaching food preservation, a qualitative approach was considered best to answer these questions.

3.4 RESEARCH SITE AND SAMPLING

The study was conducted in an urban school in the Oshana region in the Northern part of Namibia (see Figure 3.1 below).

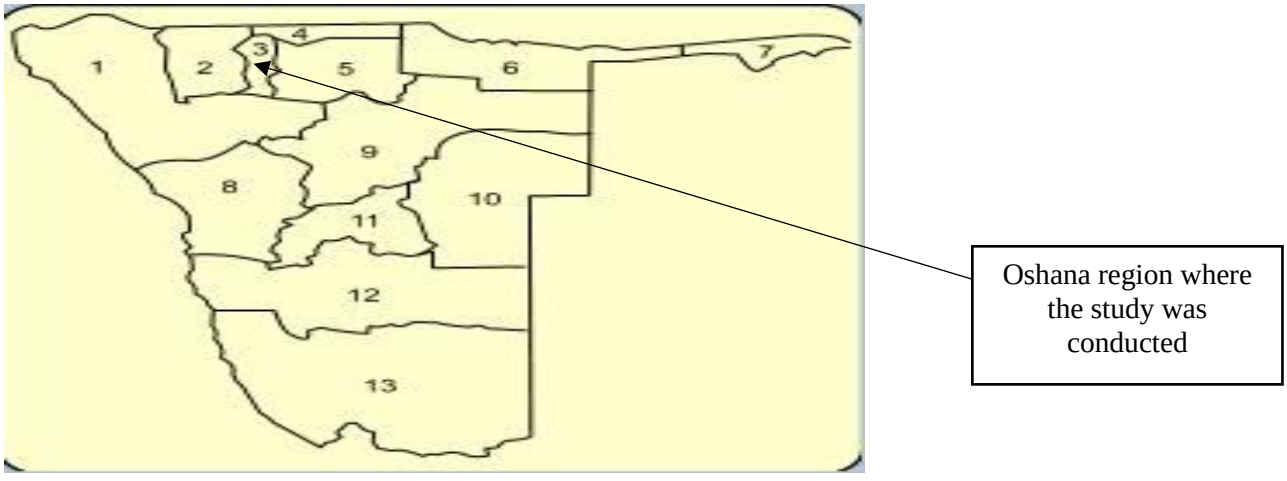

Figure 3.1: The geographical map of regions in Namibia.

The school is located at the centre of the town without hostel accommodation. Hence, the majority of learners walk to school and only a few of them come by car, particularly those who come from nearby towns. These learners come from different socio-cultural backgrounds (Mavuru & Ramnarain, 2017). This year the school enrolment was 430 learners from Grade 1 to 10. Apart from the school being centrally located, it is well-known for its outstanding performance in the Grade 10 Junior Secondary Certificate, hence attracting learners from all corners of Namibia.

Namibia's NCBE indicates that the language of instruction in schools in Namibia should be English (MoE, 2015). In addition to this, a second language should be offered and this should be determined by the dominating language spoken within that community. The language of instruction at this school is thus English as indicated in the NCBE. In addition to English, there are two first languages offered at this school: *Oshiwambo* and *Afrikaans*. In other words, this school offers two first languages, which are *Oshiwambo* and *Afrikaans*, and then English as a second language or medium of instruction.

This is necessitated by the fact that this school is composed of learners from different cultures. This was therefore done to accommodate other learners who are non-*Oshiwambo* speakers, and to further promote cultural diversity (Cooks et al., 2012; Mhakure & Otulaja, 2017). The *Oshiwambo* dialects spoken at this school by the learners are *Oshikwanyama, Oshindonga*, *Oshimbalanhu,* and *Oshikwambi*. The other non-*Oshiwambo* dialects spoken by the learners at school are *Portuguese, Subiya, Herero, Afrikaans, Shona,* and *Rukwangali*.

There is one Grade 6 class with 29 learners in total at this school. This class has a good representation of different cultural groups. At the time of this study, there were 10 *Oshiwambo* speakers, four *Portuguese,* five *Herero's*, two *Caprivians*, three D*amara,* three *Kavango* and one *Shona*. I therefore considered this composition suitable as participants in this study due to equal representation of different cultures. Hence, 29 Grade 6 learners were the first participants in this study. The other participants were the four community members, and the elementary Agricultural Science teacher. I elaborate below about my participants in this study.

3.4.1 Grade 6 learners

The Grade 6 class was purposively chosen because the topic on food preservation is only offered in this grade in the Namibian curriculum**.** Additionally, through the literature search

and review, I realised that little research has been done about food preservation in Namibia; hence I chose this topic as my research focus. Moreover, Tytler (2010) argues that for the majority of learners, their life aspirations are formed before the age of 14. If an attempt is made to engage learners earlier or soon after this age (14 years), the engagement might be easier unlike engaging older learners, and their interest in science might be boosted.

The whole class voluntarily participated in the study. Learners were given a closed-ended questionnaire to collect quantitative data and this was aimed at determining their pre-conceptions, attitudes, and interest towards the inclusion of local or IK. Thereafter, a group activity method of collecting data was employed whereby learners in groups of five had to discuss how they preserved at least five common foods in their cultures. The purpose for this activity was to create a relaxed and non-threatening environment for these learners.

3.4.2 Four community members

The four community members were selected based on the cultures in the class, namely, *Oshiwambo,* Herero, Damara and Portuguese. The community members were also selected purposively by looking at their cultural knowledge, as well their ability to present and carry out a demonstration in the class. The presentation by the *Oshiwambo* community member was done in the mother tongue while the translator translated into English for the learners, and for the Herero, Damara and Portuguese (Ngangela) presentations, they were done both in the mother tongue and English because these community members understood both languages. In addition, it was also difficult to find a translator because people from these cultures are rare in the Oshana region.

3.4.3 Teacher

The teacher was purposively selected because he is the responsible teacher for that subject in that class. Even though he has been teaching for more than five years, he also indicated that he had little knowledge on the integration of local or IK in science lessons. He thus felt that this was an opportunity for him to learn how to make science lessons culturally responsive to his learners as reiterated by Mhakure and Otulaja (2017). In hindsight, it could also be argued that this could be seen as one example of a mutual benefit in this study.

We thus co-planned model lessons together, which he subsequently taught while I observed. I believe that co-planning and discussing these model lessons together with the selected science teacher was useful in building trust and rapport amongst us. Additionally, we both learnt from the presentations made by experienced and knowledgeable parents or community members. Once more as alluded to earlier on, I thus positioned myself as a co-learner in this research project.

3.5 DATA GENERATING TECHNIQUES

This study made use of five methods to generate data, namely, questionnaires, a group activity, observations (practical demonstration lessons) and journal reflections. Cohen et al. (2011) assert that using a variety of data collection techniques allows gathering of rich data affording a researcher an opportunity to triangulate it.

3.5.1 Questionnaires

A questionnaire is a systematic list of questions that a respondent has to answer (Bertram & Christiansen, 2015). The questionnaire was aimed at collecting quantitative data regarding learners' conceptions, attitudes and interest towards science. This questionnaire was adapted from Fraser's (1981) Test of Science-Related Attitudes (TOSRA). It was a three page questionnaire with 45 questions. These questions were used as indicators for conceptions, attitude and interest toward science. They were thus grouped into three groups as shown in Table 4.3 and these categories were used to analyse data from the questionnaire which was aimed at answering my research question 1. It was completed both at the beginning and at the end of the intervention (see Appendix G). Learners were expected to tick their level of agreement for each item as strongly agree, agree, not sure, disagree or strongly disagree. Learners were however discouraged by the length and the number of questions. Since they were supposed to submit this questionnaire by the end of the lesson, I assisted them by reading each question to them one by one while they ticked off their level of agreement. This ensured that they understood the questions, which were formulated in English. In addition, there was a concern that some learners might lose or not complete the questionnaire and not return them within the two given days.

3.5.2 Group activity

The rationale for using a group activity in this study was to create a relaxed and non-threatening environment for the learners to learn and engage. Firstly, learners were asked to bring examples of artefacts used to store traditional foods at their homes (e.g. a calabash) or photographs thereof if the storage artefacts were big. The learners were numbered from 1 to 29 so that each learner had a number. These numbers were their pseudonyms and were used throughout as a label for activities. They were given stickers and they had to put their number on the artefacts that they had brought.

Out of 29 learners, three learners managed to bring clay pots, five learners brought pictures of the grain basket (*eshisha*), and the calabash for keeping milk. Some learners indicated that they could not bring the cultural artefacts because they were staying in urban areas, where these cultural artefacts are rarely used or seen. In addition, some learners did not know about these artefacts at all.

From boxes of cards labelled with the names of different Namibian ethic groups, the learners were asked to choose a card they felt they most identified with. Then they had to write their numbers on the cards. Learners were then divided into five groups of five (mixed ethnic groups). They were asked to bring their storage artefact to the group table. In this group activity, learners were required to name at least five (per group) types of traditional foods that are common at their homes and how these are stored. Traditional foods were explained with some examples by the teacher, so as to distinguish them from modern foods bought from the shops. The discussions were recorded on newsprint. This was followed with group and then a whole class discussion. The groups were given about five minutes to discuss each of the questions from the list below, and then after each five minutes there was a whole class review of their ideas.

The following questions were asked to stimulate the discussions and ideas on the main topics being investigated, using the selected main examples, e.g., *mahangu, fish, milk* and *meat*.

1. Where do families get these foods? For example, do they grow them, exchange with neighbours, or buy them from shops?
2. What are the methods of food storage used at home?
3. What do the families do to prepare the food for storage and eating?

4. What are the other more modern ways that your family uses to store food to last longer (preserve foods)?

The invited community members were asked to observe the group activity whereby the learners explained their knowledge of food preservation. The rationale for inviting the community members was that I thought that this might be useful background for them when they each do their presentations. Out of the four invited community members, however, only two (the *Oshiwambo* and Herero) managed to come. Understandably, the other two could not come because they were out of town.

Initially, the plan was to conduct the group activity within an hour. However, we ended up using more time as some learners were actively engaged. I had to postpone the group presentations to the following day due to time constraints. Most learners, particularly the girls enjoyed the lesson. Their group discussions were interesting and they came up with good work.

3.5.3 Observation, practical demonstration and videotaping

With observation, a researcher goes to the site of the study and observes what is actually taking place (Bertram & Christiansen, 2015). This technique offers a researcher an opportunity to gather live data from a naturally occurring situation (Cohen et al., 2011). A total of four lessons were observed. The first lesson was the introduction of key concepts such as preservation, traditional foods, and modern foods by the subject teacher. The second lesson was the presentation by the first two community members from the *Oshiwambo* and Herero culture. The third lesson was the presentation by the last two community members from the Damara, and Portuguese culture. The last lesson was then the concluding lesson (consolidation) by the subject teacher on food preservation in general, drawing from the presentation of the community members. With the permission of the participants, all lessons and practical demonstrations were videotaped to provide a detailed account of the information that I might not be able to capture in my notes, but which might be necessary for later transcription.

Additionally, the sociocultural perspective (Vygotsky, 1978) was used in the observation schedule adapted from Nikodemus (2017) to look in particular at the social interactions, learners' engagement and their attitudes during the four lessons. The presentations by the four community members afforded me an opportunity to position myself as a co-learner during this process as I was indeed learning together with these learners. That is, I was learning these

cultural practices together with these learners and their teacher. This gives credence to the fact that in this study I was doing a research *with* these learners rather than *on* them (Ngcoza, 2007). On the contrary, however, I was informed by the Education Higher Degrees Committee (EHDC) that the policy stipulates that any form of research whereby the participants are learners, the research is *on* them rather than *with* them. It is against this caveat that I had to complete the Rhodes University Ethical Clearance form, a process which left a bitter taste in my mouth in this journey.

Nonetheless, despite the ethical concerns raised when working with young learners, in all the four lessons observed, learners where happy, particularly those from the cultural background of the community member who was presenting. I noted that they participated very well through asking questions, and assisting with defining concepts in their mother tongue translating them to English. One learner from the Portuguese culture for example, was observed organising the seat for the community member from the Portuguese culture. Additionally, she even moved from her usual place and sat next to the community member after the presentation. Furthermore, as the community members were presenting, the majority of learners moved closer to them so that they could listen closely.

Despite that, language was a huge barrier as learners could not communicate directly with the presenters. In the case of the Herero, Damara and Portuguese community members, they were both presenters and translators because I could not get someone to translate. Some learners paid equal attention to both presenters, while others got bored as presenters whose cultural backgrounds were different from theirs were presenting. Some learners were making fun, more particularly on the pronunciation or sounding of concepts. Concepts in *Oshiwambo* and Herero sound similar, and learners could easily make the link in terms of the meaning. In contrast, Portuguese and Damara have totally different sounds and meanings, resulting in learners making fun of some of the words. Notwithstanding, it emerged from their journal reflections that some learners grasped some concepts from other cultures.

3.5.4 Journal reflections

Journal reflection plays a major role in enabling learners to identify and record their experiences and beliefs about science itself, and learning of science (Towndrow, Ling, & Venthan, 2008). In addition, journal reflection also provides learners an opportunity to express their attitudes, and to critically reflect on the activities they are engaged in. Despite the

aforementioned qualities of journal reflection, inexperienced learners, young learners in this context, might have difficulty thinking about what to write (Towndrow et al., 2008). Thus, Towndrow et al. (2008) suggest that teachers should provide guidance to their learners when writing journals. Wilson and Fox (2013) also add that the guiding questions in journal reflection can be completely open-ended or semi-structured. Furthermore, questions should be clear and unambiguous to the participants.

In this study, journal writing allowed me to access learners' experiences and attitudes on the inclusion of local or IK in a multicultural class. All learners were requested to write and reflect on each of the four lessons conducted. Due to the ineffectiveness of journal reflection highlighted above, learners wrote their journal reflections according to four open-ended guiding questions as alluded to by Wilson and Fox (2013). The guiding questions were:

1. What have you learned from this lessons?
2. What have you enjoyed in this lesson?
3. What have you not enjoyed in this lesson?
4. How can the lesson be improved?

Additionally, since these learners were second language speakers who started using English as a medium of instruction in Grade 4 (MoE, NCBE, 2015), preference was given them to write in either English or in their mother tongue.

Despite this, some learners indicated that they did not know how to write in their mother tongue. Also, the majority of the learners found it difficult to write in detail to fully and clearly express their inner feelings and experiences towards the integration of the indigenous knowledge in teaching science. Instead, they used simple or common words such as "*I enjoyed everything"*.

3.6 DATA GENERATION PROCESS

The data collection process began by obtaining permission from the Oshana Regional Director and the school principal. After that, the school principal introduced me to the Agricultural Science teacher and learners. Secondly, I introduced the study, that is, what it was all about, how I intended to conduct it, the targeted participants, the time-frame, the benefits of the study

to me and the participants, and the rights of the participants. Thereafter, I gave consent letters to the teacher and to the learners' parents involved in the study since they were still minors. Four community members who demonstrated how *fish, milk, meat* and *mahangu* are culturally preserved were selected based on the culture represented in the class. Individual meetings with the selected community members were held to explain the process of the study, their role in the study, their right to participate and withdraw at any time. Finally, I gave them consent letters.

3.7 DATA ANALYSIS

Data analysis is the process of deriving meaning from the collected data. The process of analysing data involves organising, sifting, sorting, reviewing and reducing large amounts of data to make sense of it (Cohen et al., 2011). Since this study adopted a mixed-method approach, both quantitative and qualitative data were generated. Analysis of quantitative and qualitative data happens in different ways (Bertram & Christiansen, 2015), and I now discuss these data analysis strategies separately below.

3.7.1 Approach to quantitative data analysis

As highlighted earlier in Section 3.5.1, quantitative data were generated using pre-and post-intervention questionnaires. This questionnaire consisted of 45 items whereby learners had to indicate their level of agreements which were: strongly agree, agree, not sure, disagree and strongly disagree. The 45 items were divided into three categories which emerged from my conceptual framework (see Table 4.3). Learners' responses per item were rated in each category using the rubric which I developed as seen in Table 4.4, to determine the average for each learner per category (see Appendices H to J). Data were then presented in tables and graphs, and were analysed by comparing the learners' averages and percentages in the pre-and post-intervention questionnaire per category (see Section 4.3). Moreover, extracts of textual data (qualitative data) were used to support and explain quantitative data.

As explained earlier, 29 learners participated in the study, but only 18 learners returned their pre-and post-intervention questionnaires. As a result, these 18 learners were selected for the quantitative data analysis.

3.7.2 Approach to qualitative data analysis

Qualitative data usually consists of textual or visual data (Bertram & Christiansen, 2015). Some examples are field notes, videotaped lessons, audio recorded interviews, notes made from classroom observation schedules, photographs taken of the classroom and school, video footage of the classroom or discussion of participants and ideas written on a flip chart (Bertram & Christiansen, 2015). This study generated qualitative data through a group activity, lesson observations and journal reflections.

Huberman and Miles (1994) assert that data analysis consist of four processes, namely, data reduction, data display, conclusion drawing, and verification. Data from videotaped lesson observations were transcribed first into textual data. A story was then developed from the data. As advised by Sedláček and Sedova (2017), some episodes reflecting *social interactions* and *participation* were also identified from the video transcripts.

The first process of data analysis as alluded to by Huberman and Miles (1994) of reducing data then began. Data reduction is actually an act of selecting, focusing, simplifying, abstracting and transforming data that were capture during interviews, observation, journal reflections or transcription (Bertram & Christiansen, 2015). Since qualitative data consists of hundreds of pages of text, this process was quite important to this study to reduce all these pages to become easier for me to make sense of them.

This process began with labelling data with codes from which themes and patterns were formulated. The coding technique applied to all data collected via the group activity, observations and journal reflections. Essentially, the data analysis process employed both inductive and deductive approaches. The sets of concepts from the theoretical framework were used to analyse data (Bertram & Christiansen, 2015). This approach is called the deductive approach. In this study, *socio-cultural* theory was used as a lens to analyse data.

If I entirely adhered to the deductive approach, it would appear as if I am imposing data on the theoretical concept since deductive analysis begins with sets of categories already established by the theory, socio-cultural theory in this case. To accommodate other useful data that might emerge, I employed the inductive approach as my second method of analysing data. Inductive reasoning is a process of organising data and identifying patterns among categories (Bertram & Christiansen, 2015). These categories or themes emerge from the data. In other words, with

inductive reasoning I start with raw data. Searching of patterns was done through understanding the complex links between aspects of people's situation, mental processes, beliefs and actions (McMillan & Schumacher, 2010). Instead of using the theory to make sense of the data, I engaged the literature to interpret the data.

3.8 VALIDITY AND TRUSTWORTHINESS

Validity and trustworthiness is the way in which people develop trust in findings of the study (Du Plooy-Cilliers, Davis, & Bezuidenhout, 2014). In other words, if a similar study is conducted, the findings should be more or less similar. To ensure validity in this study, data collection instruments were piloted beforehand at a different school. Piloting data collection instruments enabled me to test if they would generate the data needed to answer the research questions, and this subsequently guided me on how to improve my data collection instruments. The use of multiple data collection techniques such as questionnaires, a group activity, observations, and journal reflections enabled me to triangulate and validate data (Cohen et al., 2018).

Likewise, the information on food preservation from the questionnaires informed me on how we could co-plan the model lessons that integrated local or indigenous knowledge together with the Agricultural Science teacher at this school. Co-planning of lessons was another validation technique in this study. During observations, a video recorder was used to capture aspects that I may have missed in the observation schedule. I used verbal data as evidence to support claims in my data analysis. In addition to the written reflections by the learners, I also made time to reflect together with the teacher so that we could collaboratively validate the data generated. Also, by inviting the four community members to give presentations on how they preserve food in their different cultures lent itself to a validation process for the inclusion of local or indigenous knowledge, in particular, from the community members' perspectives. This is akin to getting and accessing first-hand information.

It is acknowledged, however, that each instrument has its advantages and disadvantages. For example, using a video recorder on learners who are not used to it might influence their behaviour in class. Thus, a video recorder was introduced before the date of collecting data for them to get used to it.

3.9 ETHICAL CONSIDERATIONS

Ethics is an important consideration in every research (Bertram & Christiansen, 2015). In this study, research ethics where adhered to throughout the research process. Firstly, I obtained the clearance certificate from Rhodes University which served as a starting point of the study. Since the study was conducted with learners at a school, permission was obtained from the Oshana Regional Education Director (see Appendix B), and from the school principal (see Appendix D).

After that, the school principal introduced me to the Agricultural Science teacher and learners. Secondly, I introduced the study, that is, what it was all about, how I intended to conduct it, the targeted participants, the time-frame, the benefits of the study to me and the participants, and the rights of the participants. Thereafter, I gave consent letters to the teacher and to the learners' parents involved in the study since they were still minors. Four community members who demonstrated how *fish, milk, meat* and *mahangu* are culturally preserved were selected based on the culture represented in the class. Individual meetings with the selected community members were held to explain the process of the study, their role in the study, their right to participate and withdraw at any time. Finally, I gave them consent letters. Permission to use leaners' and community members' photos was also granted.

3.10 CONCLUDING REMARKS

In this chapter, I discussed the interpretive paradigm underpinning this study. This was followed by a discussion on the mixed-method approach, the case study, data generating techniques, research procedure, sampling, and the inductive and deductive approaches used in data analysis. Finally, I concluded the chapter with a discussion on the validity and the ethical considerations in this study.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSION OF QUANTITATIVE DATA AND REFLECTIONS

4.1 INTRODUCTION

In the previous chapter, I presented the research design and methodology underpinning this study whose main goal was to investigate whether or not learners' conceptions, attitudes, and interest are influenced by integrating local or indigenous knowledge when teaching food preservation in a multicultural class. In this chapter, I thus present, analyse and discuss the quantitative data generated from the pre-and post-intervention questionnaires as well as the qualitative data from the group activity to answer the following research questions:

1. What are the Grade 6 learners' conceptions, attitudes, and interest towards science?
2. What local knowledge do Grade 6 learners have on the topic of food preservation?

This chapter begins with a profile of the 29 learners who participated in this study. This is followed by the presentation, analysis and discussion of quantitative data from pre-and post-intervention questionnaires, and then the qualitative data from a group activity. The chapter ends with some concluding remarks. Below are the keys and pseudonyms used for the participants in this study.

Table 4.1: Keys and pseudonyms used in discussion of data

Learner 1 - 29 Male/Female	L1 - L29M/F
Group 1 - 5	G1 - G5
Questionnaire Learner 1 - 18	QL1 - QL18
Reflection Learner 1 - 18	RL1 – RL18
Damara community member female	DCF
Oshiwambo community member female	OCF
Portuguese community member male	PCM
Herero community member female	HCF

4.2 LEARNERS' BIOGRAPHICAL INFORMATION

As alluded to earlier, the overall sample in this study consisted of 29 learners coming from diverse socio-cultural backgrounds and their profiles are presented in Table 4.2 below.

Table 4.2: Biographical information of learners who participated in the study

Biographical information	**Categories**	**Learners 'code**	**Frequency**
Age	**11 - 13**	RL2M, RL3F, RL4F, RL5F, RL6M, RL7F, RL8F, RL10F, RL11M, RL12M, RL14F, RL15F, RL16F, RL17F, RL18M, RL19M, RL20F, RL23F, RL24M, RL25F, RL26M, RL27M	**22**
	14 - 15	RL1M, RL9F, RL13F, RL21F, RL22F, RL28M, RL29M	**7**
Gender	**Male**	RL1M, RL2M, RL6M, RL11M, RL12M RL18M, RL19M, RL24M, RL26M, RL27M, RL28M, RL29M	**12**
	Female	L3F, L4F, L5F, L7F, L8F, L9F, L10F, L13F, L14F, L15F, L16F, L17F, L20F, L21F, L22F, L23F, L25F,	**17**
Cultural background	**Caprivian**	L5F	**1**
	Damara	L16F, L18M, L24M,	**3**
	Herero	L3F, L5F, L6M, L10F, L13F,	**5**
	Kavango	L2M, L11M, L27M	**3**
	Oshiwambo	L1M, L4F, L7F, L8F, L12M, L17F, L19M, L20F, L21F, L25F	**10**
	Portuguese	L9F, L16F, L22F, L23F,	**4**
	Shona	L29M	**1**

As evidenced by the biographical information provided in Table 4.2 above, all 29 learners willingly participated in this study. In terms of learners' age, 22 learners (76 %) were between the ages of 11 and 13 years, while seven learners (24%) were between the age of 14 and 15 years. With regard to their gender, 12 learners (41%) were males, whereas 17 learners (59%)

were females. In terms of their cultural backgrounds, 10 learners (34%) were *Oshiwambo* speakers, five learners (17%) were Herero speakers, four learners (14%) were Portuguese, three learners (10%) were from Okavango and Damara culture, and one learner (3%) from each of the Caprivian and Shona culture.

The data revealed that this class was indeed made up of diverse cultures making the class multicultural. It was however, dominated by the *Oshiwambo* speakers, perhaps because the school is in the region where more than 85% of the population are *Oshiwambo* speakers. Notably, Portuguese and Shona are foreign cultures in Namibia. Portuguese is a culture from Angola whereas Shona is from Zimbabwe. In total, five learners (17%) who participated had foreign cultural backgrounds.

4.3 PRESENTATION, ANALYSIS, AND DISCUSSION OF PRE-AND POST-INTERVENTION QUESTIONNAIRES

Before I gathered data for my main study, I administered a pre-intervention questionnaire to a Grade 6 class consisting of 29 learners (see Section 4.2). The pre-intervention questionnaire was administered before the intervention to establish learners' prior conceptions, attitudes and interest towards science. This was followed with an intervention which took about five weeks. However, the quantitative data were only analysed based on the 18 learners who returned their pre-and post-intervention questionnaires. These learner were given codes as per Table 4.1.

The questionnaire consisted of 45 questions (see Section 3.5.1). These questions were grouped into three main themes which emerged from the conceptual framework. The categories were: conceptions, attitude, and interest. I now present the data from the pre-intervention questionnaire.

Table 4.3: Categories of question

Categories	**Questions**	**Frequency**
Conception	1, 2, 4, 24,25,27,30, 31, 38 & 39	10
Attitude	3,5,6,7,8,9,10,11,12,15,16,18,19,20,22,28,29,32,33,34,35,36,37, 40 & 41	25
Interest	13, 14, 17, 21, 23, 26, 42, 43, 44 & 45	10

The results in Table 4.3 show that 10 questions (22%) from the questionnaire were measuring the learners' conceptions towards science, 25 questions (56%) were measuring the learners'

attitude towards science and 10 questions (22%) were concerned with the learners' interest in science.

Prior to the analysis of quantitative data, I designed a rating rubric based on the items in the questionnaire. The questionnaire had five levels of agreements, namely, strongly agree, agree, not sure, disagree, and strongly agree. The learners' responses per item were rated as either low, moderate or high in the three category as seen Table 4.4 below.

Table 4.4: The rubric used to rate the learners

Category	**Low (1)**	**Moderate (2)**	**High (3)**
Conceptions	Learner does not see the relevance of learning science	Learner views science as important but does not try to learn it	Learner is able to establish the relevance of learning science
Attitude	Learner gives up easily when the content is difficult	Learner tries to seek help when the content is difficult	Learner does not give up and tries to find a solution to a given problem
Interest	Learner is not interested in learning science concepts	Learner tries to take part in science activities even though they do not really understand them	Learner enjoys science activities and tries to understand science concepts

The three categories; low, moderate and high were developed based on the confidence of the learners' responses. For example, item 3 reads "*I am sure I can do well in science tests*". A learner who indicated "not sure" demonstrates weak attitude toward science and was rated "low", while a learner who indicates "strongly agree" demonstrates a strong attitude towards science, and was rated "high". The rubric was used in such a way that a learner who is rated low, was awarded 1 point, 2 points for moderate, and 3 points for high. Each learner was rated per item in the questionnaire in both the pre-and post-intervention questionnaire (see Appendices H to J) to determine the average for each learner per category as shown in Table 4.5.

Table 4.5: Summarised learners' results

Learner	**Conceptions**		**Attitude**		**Interest**	
Questionnaire	**Pre-**	**Post-**	**Pre-**	**Post-**	**Pre-**	**Post-**
QL1	2	2	1	2	1	3
QL2	1	3	2	2	1	2
QL3	2	3	2	2	2	3
QL4	2	3	2	2	1	3
QL5	2	2	2	2	2	3
QL6	2	3	2	3	2	3
QL7	1	2	1	2	1	3
QL8	3	3	2	2	2	3
QL9	1	3	1	2	1	3
QL10	2	2	1	1	1	2
QL11	2	3	2	2	2	3
QL12	2	3	2	2	2	3
QL13	2	3	2	2	2	3
QL14	2	3	2	2	2	3
QL15	1	3	1	2	2	3
QL16	2	2	1	2	2	2
QL17	3	3	3	3	3	3
QL18	1	3	1	3	1	3
Class average	**2**	**3**	**2**	**2**	**2**	**3**

Table 4.5 shows the summarised learners' responses from the questionnaires. That is, it shows how individual learners' conceptions, attitude and interest had shifted as a result of the intervention. In addition, the table also shows the average class' shift in the three categories. For further comparisons, these results were converted to percentages as presented in Table 4.6 below.

Table 4.6: The percentage results per category

Category	Low (%)		Moderate (%)		High (%)	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Conceptions	28	0	61	28	11	72
Attitudes	39	6	56	77	6	17
Interest	39	0	55	17	6	83

Table 4.6 shows the percentage of learners' responses per category before and after the intervention. These data were further presented on bar graphs below, beginning with conceptions, attitude and interest.

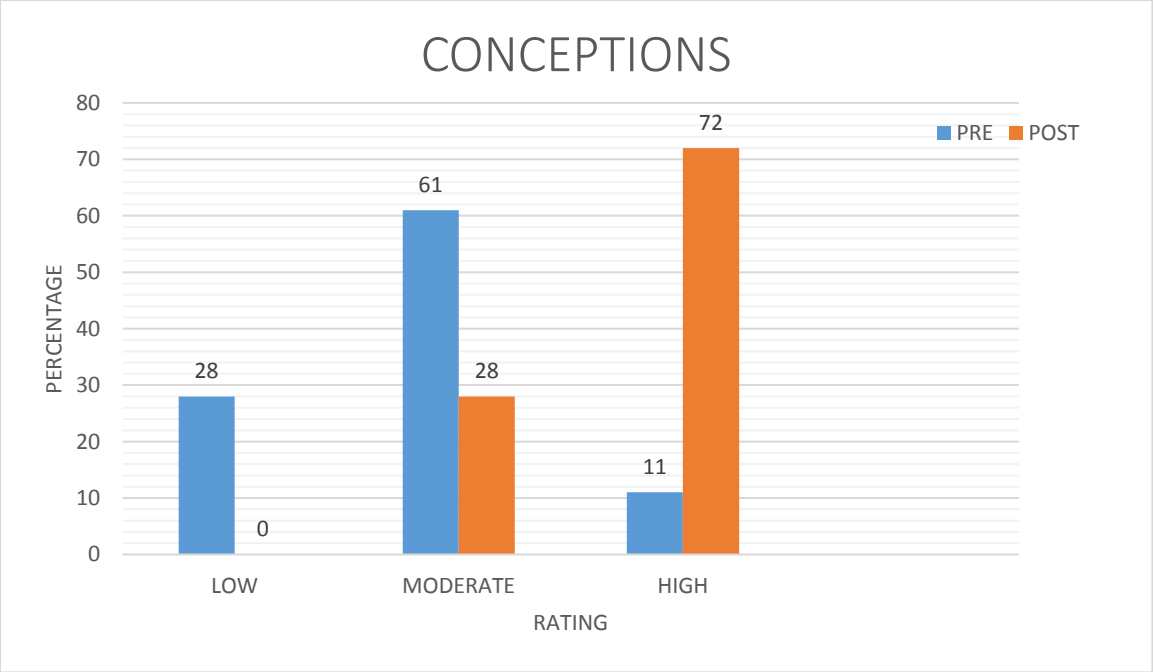

Figure 4.1: The learners' conceptions towards science

Table 4.6 shows that five out of 18 learners (28%) had a low conception about science, 11 learners (61%) were moderate, and two learners (11%) had high a conception prior to the intervention. After the intervention, no learner had a low conception about science, five learners (11%) had a moderate, and 13 learners (72%) had a high conception about science.

This suggests that after the intervention there was a shift in learners' conceptions towards science to either moderate or high. This is evident in Figure 4.1, Tables 4.5 and 4.6 above. Further evidence was also revealed by the learners in their reflections. For example, one learner

reflected that "*The lesson can be improved by even showing how different cultures preserve. Because showing is better and more understanding than telling"* (RL1).

This shows that the integration of IK, more particularly the cultural artefacts as indicated by RL1, helped them to make sense of what they were being taught. This finding is in agreement with Vygotsky (1978) who is of the view that culture provides tools that mediate learning. To this end, one learner was of the view that, "*showing is better and more understanding than telling*". Govender (2014) alluded that science is too abstract. However, the integration of African knowledge helps learners to make sense of abstract science in the way it is taught. Tsai (2004) reported that there is a profound relationship between learners' conceptions and their performance in science. In addition, Howie (2004) also highlighted that, among others, learners' perceptions of the importance of science is one of the factors which influence learners' attitude towards science. Thus, it is assumed that learners whose conceptions had shifted as a result of the intervention hopefully developed more positive attitudes towards science. In the next graph, I present learners' attitude towards science before and after the intervention.

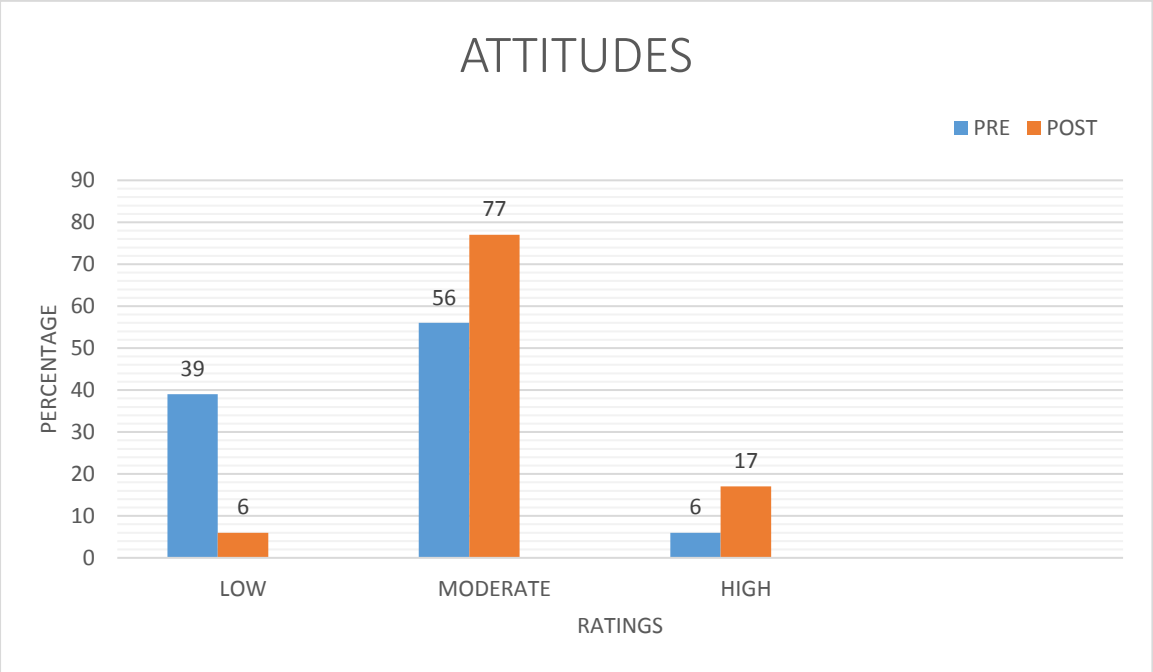

Figure 4.2: Learners' attitudes towards science

Figure 4.2 shows that seven out of 18 learners (39%), had a low attitude towards science, 10 learners had moderate, and one learner had a high attitude towards science before the intervention. After the intervention, however, there was a significant shift in learners' attitudes towards science. For instance, the number of learners with a low attitude declined to 6%, that

is, a shift of 33% to either moderate or higher. Despite the decline in number of learners with a low attitude, there was only a slight increase of two learners with a high attitude towards science. This suggests that most learners shifted from low to medium attitudes towards science.

When the shift in learners' conceptions and attitudes were compared, the shift in learners' conceptions was significantly higher than the shift in attitude. To establish why the shift trend from conception had not continued with regards to attitude, further analysis was made on the summary of the individual ratings.

The data revealed that most learners did not acquire the culture of doing science. For example, item 12 of the questionnaire which was assessing how learners learn science, 15 out 18 learners were rated low (see Appendix G). They indicated that when they were learning new science concepts, they memorised them instead of learning them with understanding. The small shift in learners' attitudes may also be attributed to the fact that these learners were still in the foundation grade where they are in the process of building basic science knowledge and immersing themselves in the culture of science. The same sentiment was echoed by De Witt et al. (2011) who alluded that learners' attitudes were established before they enter the secondary school level. Thus, it may be argued that these learners are still at a stage where they have to make the choice whether to follow science or not. This suggests that teachers need to make science meaningful and interesting to learners at this level (Tytler, 2010). In the next graph, I present the learners' interest before and after the intervention.

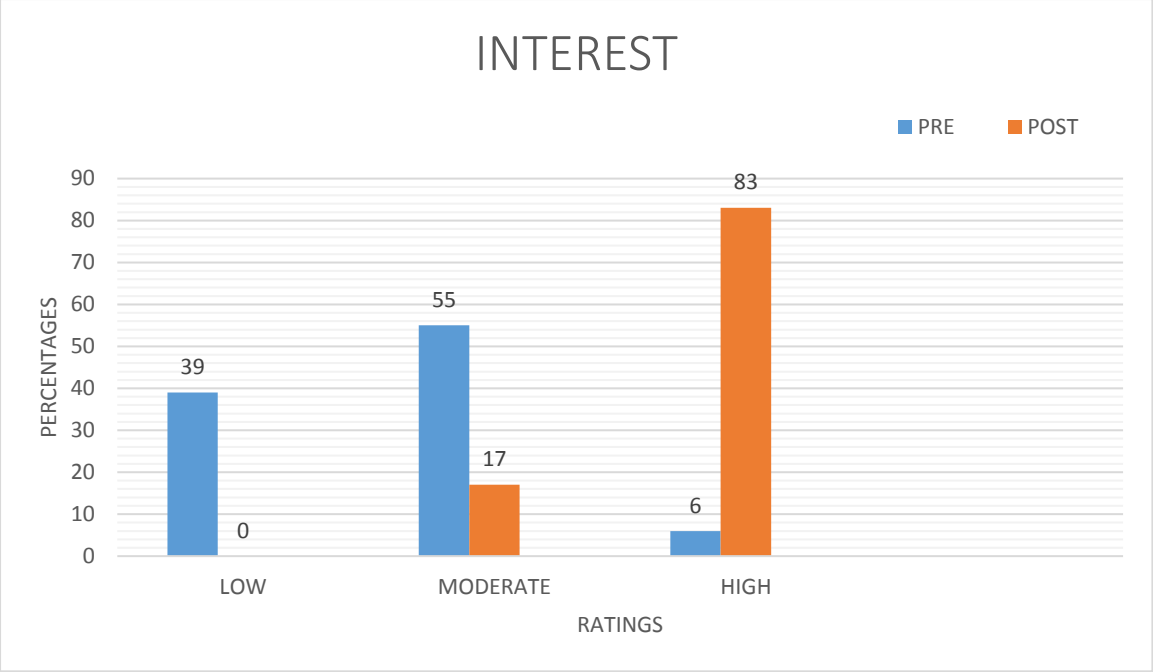

Figure 4.3: The learners' interest towards science

Figure 4.3 shows that seven out of 18 learners (39%) had a low interest in science, 10 learners were moderate, and only one learner had a high interest in science before the intervention. After the intervention, however, there was a significant shift in learners' interest in science from low interest to either moderate or high as a result of the intervention. The percentage of learners who had a low interest all shifted as after the intervention the number was zero.

From these findings, it could be deduced that the integration of indigenous knowledge in teaching the topic of food preservation had positively influenced learners' interest in science.

Moreover, this finding is also evident in the learners' reflections:

> *I enjoyed being explained [to] by my friends.* (RL8)
>
> *I enjoyed everything because everything was very interesting and I learned new things from the Herero culture and the Ovambo culture.* (RL1)

When learners were reflecting on the part of the lesson that they did not enjoy, most learners insisted that the lesson was enjoyable. For example, they reflected that:

> *I enjoyed everything. There is nothing I didn't enjoyed because I learnt a lot of new things that I didn't know.* (RL1)
>
> *Nothing because everyone enjoyed it so much.* (RL3)

I enjoyed everything. (RL2, RL4, RL5, RL7 & RL10)

The responses from the learners seem to suggest that they found the lesson very interesting. This finding concurs with Manzini (2000) whose study revealed that learners show greater interest in learning if it is related to their socio-cultural setting. In addition, learners may also show interest if they find the science content relevant to their daily life, and to the society in which they live (Hofstein & Mamlock-Naaman, 2011). In the context of this study, the information on food preservation was useful to the learners since they could use it in their daily life, something which stimulated their interest. Nyika (2017) has also echoed the same sentiment that if what learners are being taught is personally relevant, they become motivated to take part in the lesson.

Literature has however indicated that learners', particularly African, interest in science might be affected by the way science is taught in schools (Aikenhead & Jegede, 1999). These scholars posited that learners are taught in the western context which side-lines their African experiences, making it difficult to them to make the connection between what they know from home to what they are learning in the class.

4.4 SUMMARY OF QUANTITATIVE DATA RESULTS

The data revealed that as a result of the intervention all three categories: conceptions, attitudes, and interest had shifted positively from low to moderate or high. Among the three categories, the highest shift was noted in learners' interest, followed by conceptions, and lastly attitudes. Literature has indicated that learners' interest in science leads to the development of positive attitudes towards science (Hofstein & Mamlok-Naaman, 2011). Conceptions and attitudes are linked in such a way that they depict the learners' view. However, their differences are more about how they occur. Conceptions are a mental process, while attitudes are an act of manifesting views which emanate from that mental process.

4.5 PRESENTATION, ANALYSIS, AND DISCUSSION OF QUALITATIVE DATA GENERATED FROM GROUP ACTIVITY

In this group activity, learners were divided into groups of five. Learners were encouraged to form groups with diverse cultures for them to be able to learn from one another. Tonbuloglu et al. (2016) suggested that to succeed in multicultural classes, a teacher should employ culturally sensitive strategies and ensure equal opportunities to all the learners. To ensure that the data

generated from this group activity were authentic and answered the research question, learners were given five guiding questions to focus on and direct their discussions in groups. For instance, learners were first asked to mention five traditional foods at their homes and thereafter they were required to discuss the following questions:

1. Where do parents get these traditional foods?
2. What do families do to prepare these traditional foods for storage?
3. What methods do families use to store these traditional foods at home?
4. What are other modern ways that your families use to store or preserve food?

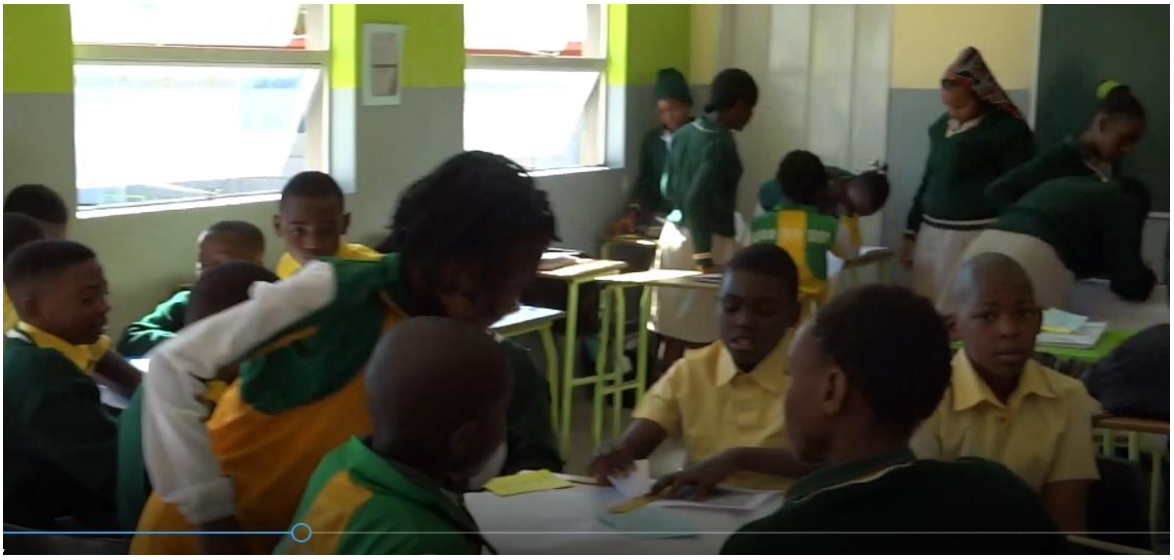

Figure 4.4: Learners discussing in groups

After the group discussions, learners presented their findings to the entire class as shown in Figure 4.5 below.

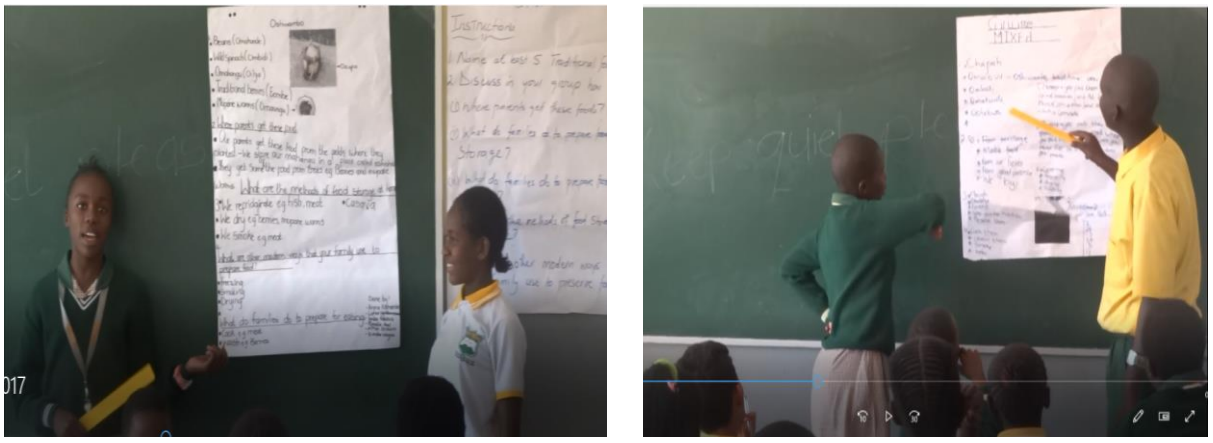

Figure 4.5: Learners presenting to the entire class

Each group had a name as shown in Figure 4.5. Most of the groups' names were decided based on the learners' culture in the group. For example, the mixed culture group, consisted of learners from different culture. The groups' name made it easier for other learners to be able to relate well to the information that they presented.

After the allocated time of 40 minutes, only five out of the six groups managed to finish their discussions and have their posters ready for presentation. Thus, only data from these five group presentations were used in this analysis. These groups were given codes as per Table 4.1. The presentation was made in accordance to the guiding questions, and learners were given a maximum of five minutes to ask questions from the presentations. For example, in G5, one of their traditional foods that they identified was cassava. A learner asked them, "*Is cassava a plant or a food*?" The presenters replied that "*cassava is a food*", without a detailed explanation. However, a learner from another group volunteered to explain what cassava was.

From the learners' presentations, four themes emerged, namely, the type of traditional food; the source of traditional food; storage/preservation of traditional food; and modern ways of preserving food. These themes were used to analyse the data in order to answer research question one. The presentations of all the five groups were summarised and are presented in Table 4.7 below.

Table 4.7: Group responses on the group activity

Guiding questions	**Groups**				
	G1: (Oshiwambo)	**G2:** (Oshiwambo /kavango)	**G3**: (Culture mixed)	**G4:** (Oshiwambo/Portuguese)	**G5:** (Oshiwambo)
Type of traditional food	• Beans (Omakunde) • Wild spinach (ombidi) • Omahangu (Oilya) • Traditional berries (Eembe) • Mopane worms (Omaungu)	• Beans • Mahangu • Maize • Mopane Worms • Oshikundu (mahangu)	• Chapati • Omalovu-oshiwambo traditional beer • Ombidi • Omakunde • Oofukwa • Omazjozondombe (butter)	• Oshifima (mahangu) • Eembe • Meat • Omakunde • Fish • **Feijoada**	• Mahangu • Beans • Ground nuts • Wild spinach • Cassava
Source of traditional food	• Our parents get these food from the fields where they planted • They get some of the food from trees e.g. Berries and Mopane worms	• **Beans**: we plant the beans and we grow them • **Mahangu**: we plant mahangu in the field and when it is ready, we cut the head and chop them with the mahangu machine • **Maize**: plant them • **Mopane worm**: get from tree • **Oshikundu**: get from mahangu	• From village • Make food • From our fields • From grand parents • We buy	• **Oshifima:** from mahangu or maize • **Eembe:** collect from trees • **Meat:** from pig and cows	• We produce in farms and some from trees **E.g.:** wild berries, Mopane worms

Storage of traditional food	• We store our mahangu in a place called “eshisha”. • We refrigerate e.g. fish, meat, cassava • We dry, e.g. berries, Mopane worms • We smoke e.g. meat	• Grain basket, • Clay pot • Calabash for milk (they used/ pasted pictures)	• Cook them • Steam them • Smoke • Braai	• Put in clay pots • Dry them • Put in omashisha	• They store it in clay pots • They dry them • They store mahangu in Omashisha
Modern ways of food storage	• Freezing • Smoking • Drying	• Canning • Freezing • Drying	• Canning • Freezing • Drying • Smoking	• They freeze them • They put the mahangu in bags (sacks) • They can the meat	• They can the food • Freeze the food • Heating the food

From the results, it emerged that beans were identified by all the five groups. *Mahangu* was the second highest and was identified by four groups, followed by wild spinach (*Ombidi*), identified by three groups, and then mopane worms, ground nuts, berries and *Oshiwambo* traditional beer identified by two groups. Other foods such as maize, meat, fish, *omaadi eengobe* (butter), *chapati*, and *cassava* were each identified by one group. Considering the learners' ages, I realised that the time given (40 minutes) for the discussion and compilation of the presentations was not enough. Notwithstanding, the quality of data learners produced signified that learners are loaded with a lot of science from their home backgrounds that a teacher can take advantage of (Ogunniyi, 2007). However, if I were to do this study again and in line with the socio-cultural perspective (Lemke, 2001, Vygotsky, 1978), I would first ask learners to compile their findings and prepare their presentations which would be done the following day.

The traditional food identified by the groups are summarised in Table 4.8 below.

Table 4.8: Shows a summary of traditional food

Types of traditional foods	**Groups (G)**	**Frequency**
1. Beans	G1, G2, G3, G4, and G5	5
2. Mahangu	G1, G2, G4, and G5	4
3. Wild spinach	G1, G3, and G5	3
4. Mopane worm	G1, and G5	2
5. Ground nuts (*eefukwa*)	G3, and G5	2
6. Berries	G1, and G4	2
7. Oshiwambo traditional beer	G2, and G3	2
8. Meat	G4	1
9. Fish	G4	1
10. Butter	G3	1
11. Chapati	G3	1
12. Cassava	G5	1
13. Maize	G2	1
14. Feijoada	G4	1

From the results in Table 4.8, it seems that beans are traditional foods known by the majority of learners in this class, followed by *mahangu* and wild spinach. Additionally, mopane and

ground nuts are traditional foods for many learners in the class. It is noteworthy that the majority of foods identified were mostly or commonly found in the *Oshiwambo* culture. It is recognised, however, that this could be due to the fact the class was dominated by *Oshiwambo* speaking learners. Of interest, though, was that *chapatti*, *feijoada*, and *cassava* were new to most learners, particularly *Oshiwambo* speakers because these are traditional foods for the Portuguese and Shona. For example, L2 reflected that: *"In the lesson I learnt a new traditional food chapati, omalovu and feijoada but chapati is the traditional food for Tanzanian food and feijoada is the traditional food of the Portuguese and the omalovu is Oshiwambo traditional beer that is in Namibia"*. Also, L10 added that, *"I learnt more about cassava, ground nuts, wild spinach and chapati. I also learnt about what we call omutoko and feijoada"*.

Regarding the source of traditional foods, five groups indicated that they get these foods, particularly berries, and mopane worms from trees (G1, G2, G4 & G5). *Mahangu* and beans are mainly harvested from their fields/plantations (see G1, G2, G3 & G5). In addition, group three (G3) indicated that some traditional foods can be sourced from the village, and some can be bought from shops.

Regarding the storage of traditional foods, four groups indicated that *mahangu* is stored in *omashisha* (grain baskets*)* as show in Figure 4.6 below.

Figure 4.6: Shows okashisha (grain basket)

As shown in Figure 4.6, *okashisha* is traditionally made from sticks weaved together with barks. It is always raised from the ground to avoid the *mahangu* from getting moisture and heat from the ground. It is placed under the roof of the hut to protect it from excess heat and rainfall.

Three groups indicated that some traditional foods, for example, mopane worms and berries are dried and stored in the clay pots. G2 indicated that milk is stored in an *oxupa* (calabash).

Group three indicated smoking as one of the ways of storing traditional food to last longer as highlighted by Aluga and Kabwe (2016). When they were asked to elaborate on this, they used the example of beans. In the *Oshiwambo* culture, beans are tied in bundles, and are hung in the cooking hut. The heat and the black smoke from the fire protects the beans from microbes that feed on beans, making it last longer.

Also in their presentation, G3 clarified that before storing *mahangu* in *omashisha* (grain baskets), *omutoko* (wood ash) is applied all over the interior of the *eshisha* (a grain basket) to prevent pests and insects that feed on *mahangu* (see Figure 4.6).

There are however other storage methods such as freezing, steaming, and braying indicated by the G3 but other groups did not agree with them because they were based more on western culture. My assumption is that this could be attributed to the fact that many of these learners are living in town where most of the items and practices in use are based more on western culture. Learners who are not exposed to their cultural practices at an early age might not be able to differentiate between their culture and western cultural practices because they have missed the opportunity to learn these knowledges from the previous generations which are mostly gained as people live and work in their communities (Nyika, 2017).

Regarding the modern ways of food storage, all five groups indicated freezing as a modern way of food preservation (G1, G2, G3, G4 & G5). Four groups out of five (80%) who completed this question, indicated canning (G2, G3, G4 & G5), a way of storing food in cans. Drying was another method which emerged as both a traditional and modern way of storing/preserving food (G1, G2 & G3). This finding supports Kibirige and Van Rooyen (2006) who disagreed with the act of putting IK in opposition to WS as if these two types of knowledge are different. Hence, Cronje et al. (2015) suggested that these two knowledges should complement each other. Other modern ways of food preservation that were identified were smoking, heating and putting food in sacks.

4.6 SUMMARY OF THE FINDINGS

The findings revealed that the learners involved in this study had prior knowledge of different types of traditional foods. For instance, commonly known traditional foods for

more than 80% of the class were beans, wild spinach, berries and *mahangu*. The majority of learners knew that traditional foods were mostly gained from the fields, as most of the people are subsistence farmers, while some foods are collected from trees. Some learners were able to explain methods of preserving foods such as *mahangu* and beans, even though they could not provide a detailed explanation of what makes wood ash suitable for use in preserving *mahangu*.

Worth noting is that even though the majority of the learners were able to differentiate between traditional and modern foods, I however observed and anticipate that, as time goes by, most learners might find it difficult to differentiate between traditional and western cultural foods or practices. This is because they are growing up in towns, where these cultural practices are hardly practised making it difficult for the transition of these knowledges from one generation to the other, as cautioned by Kibirige and Van Rooyen (2006). Moreover, Aluga and Kabwe (2016) argued that cultural methods of food preservation are likely to decline since they cannot preserve enough food to meet the demands of large populations of people in towns.

In town, food, equipment and practices are more of the western culture. Western culture is more powerful (Mukwambo et al., 2014), and many young people particularly the youth want to associate with it more than their own culture (Mhakure & Mushaikwa, 2014). This situation might cause confusion among many African learners because they are losing their culture which defines their identity (Cooks et al., 2012; Kibirige & Van Rooyen, 2006).

4.7 SOME REFLECTIONS

Throughout the group activity, I noted that learners' participation was very high. This suggested that through the group activity risks were minimised while on the other hand social interactions were maximised. For instance, the Agricultural Science teacher commented that even those who minimally participated in his normal lessons in the past were observed actively participating during the intervention. This finding corroborates with Vygotsky (1978) who argued that learners learn best through social interactions.

The involvement of cultural artefacts in the lesson served as a tool which mediated learners' thinking, and enhancing their participation. The study also noted that learners' interest was very high. Every learner was keen and eager to learn from one another. Usually, based on my experience in normal lessons, it is the teacher who takes the responsibility of managing the

noise and keeping order in class. However, in this activity, learners were observed telling others to keep quiet or sit down when their view was interrupted. This affirms the findings by Klein (2011) who alluded that learners show greater interest in learning if it is related to their socio-cultural context.

4.8 CONCLUDING REMARKS

In this chapter, I presented, analysed and discussed quantitative data from the pre-and post-intervention questionnaire, as well as qualitative data from the group activity. Quantitative data revealed that learners' interest in science lessons where IK is integrated was very high, followed by conceptions, and then attitude. Qualitative data from the group activity revealed that learners knew that *mahangu* is stored in a grain basket where wood ash is applied in the interior to prevent pesticides. Additionally, mopane worms, and berries were preserved by putting them in clay pots, while beans were hung in the cooking huts.

In the next chapter, I present, analyse and discuss qualitative data from lesson observations, and learners' journal reflections.

CHAPTER FIVE: DATA PRESENTATION, ANALYSIS, AND DISCUSSION AND DISCUSSION OF QUALITATIVE DATA

5.1 INTRODUCTION

In the previous chapter, I presented, analysed and discussed data from pre- and post-intervention questionnaires, as well as a group activity. In this chapter, I thus present, analyse and discuss qualitative data derived from observing the four community members' presentations to answer the following research questions:

- How do Grade 6 learners react and respond to the presentations on traditional ways of preserving food made by the community members?
- How do the community members' presentations on traditional ways of preserving food influence (or not) learners' conceptions and attitudes in a multicultural class?

The chapter begins with the profiles of the four community members, followed by the presentation, analysis, and discussion of data, and I end the chapter with some concluding remarks.

5.2 COMMUNITY MEMBERS' PROFILES

As discussed in Section 3.4, four community members were invited to participate in this study. They were selected from the different cultures represented in class (see Section 3.4). These community members were: one from the Damara culture, one from the Herero culture, one from the Oshiwambo culture, and one from the Portuguese culture. Vygotsky (1978) has argued that learning is constructed as a result of social interactions between the learner and the more knowledgeable one. These community members who were regarded as more knowledgeable were invited to come and demonstrate how *mahangu*, *fish*, *milk*, and *meat* are preserved in their respective cultures. They were given codes as per Table 4.1. Their biographical information is summarised in Table 5.1 below.

Table 5.1: Shows the biographical information of the four community members

Biographical information	Category	Community member code	Frequency
Age	30-45	DCF, HCF, PCM	3
	45-60	OCF	1
Gender	Male	PCM	1
	Female	DCF,HCF, & OCF	3
Cultural background	Damara	DCM	1
	Herero	HCF	1
	Oshiwambo	OCF	1
	Portuguese	PCM	1

Table 5.1 shows that four community members participated in the study. Three community members were three females, and one male.

5.3 PRESENTATION, ANALYSIS AND DISCUSSION OF QUALITATIVE DATA

The intervention study consisted of four lessons as illustrated in Figure 5.1 below.

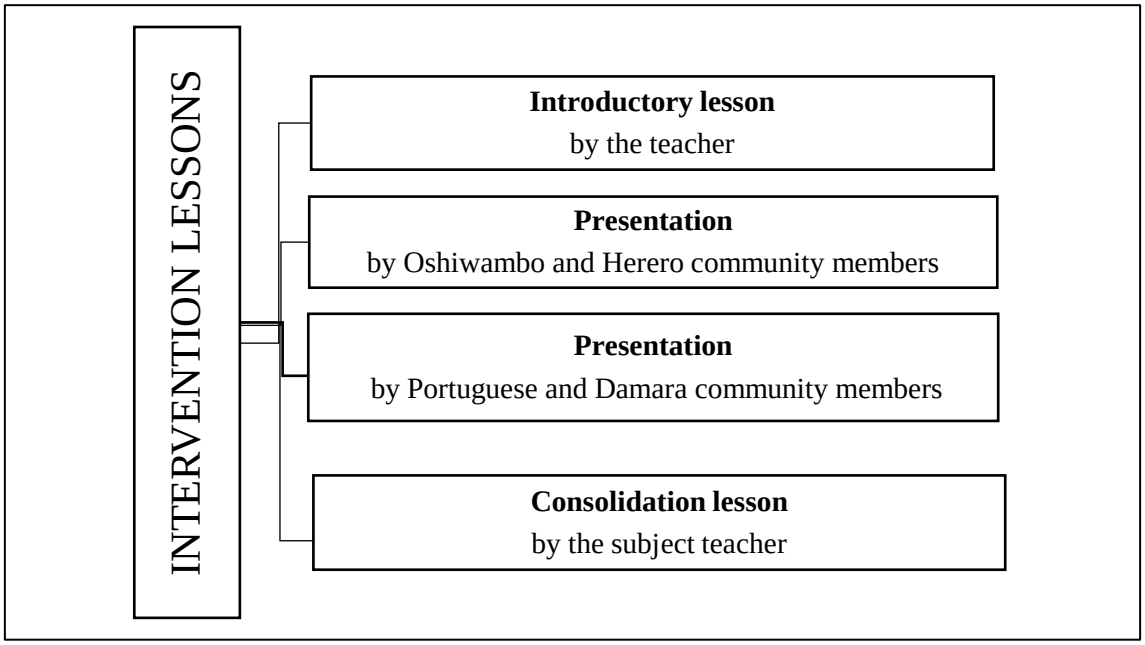

Figure 5.1: The sequence of lessons in this study

The introductory lesson was conducted by the Grade 6 Elementary Agricultural Science subject teacher. The lesson was aimed at introducing learners to the key concepts in the topic of food preservation, namely, food preservation, traditional food, modern food, and cultural artefacts. In the same lesson, learners were also asked to bring cultural artefacts or pictures of cultural artefacts for the group activity (see Section 4.5).

Lessons two and three were conducted by the four community members. The *Oshiwambo* and Herero community members presented lesson two, whereas the Portuguese and Damara community members presented lesson three. These community members were grouped taking into consideration time needed, and for the learners to be able to see the commonalities and differences between these cultural practices. In addition, grouping considered the availability of the community members.

Lesson four was a consolidation lesson, and it was conducted by the subject teacher. This lesson was based on the learning objectives in the Grade 6 Elementary Agriculture syllabus, drawing from the presentations done by the four community members. Data from lessons two, and three, as well as learners' reflections were analysed to answer the third and the fourth research questions.

I now present the summary of the lesson presentations by the four community members. The summary is presented according to the foods.

5.3.1 Preservation of *mahangu* (wheat)

In the *Oshiwambo* culture, wheat is called *mahangu*. The *Oshiwambo* speaker narrated that *mahangu* is the main traditional food for the Ovambo people. As a result, she highlighted that most of the Ovambo people farm *mahangu*. She further explained that after *mahangu* is harvested, it is stored in an *okashisha* (grain basket) so that it can last longer. The grain basket is made from sticks mainly from the mopane tree or the bitter brush and is weaved together (see Figure 4.6). Mopane is used because it is strong and can last longer, whereas the bitter brush is also strong and bitter making it unfavourable for insects who feed on dry sticks.

Before *mahangu* is stored, the grain basket is prepared by plastering the interior with mud, to fill up the small spaces where *mahangu* can get out through. After it is dry, ash is then applied all over the interior of the grain basket. In the *Oshiwambo* culture, the ash of the leadwood tree

is mainly used for this purpose, because when it is used, it has been noted that *mahangu* lasts longer in the grain basket without spoilage. The purpose of applying wood ash inside the grain basket is to prevent insects from entering. *Mahangu* is then poured in the grain basket until it is full. The grain basket is then covered with a lid called *oshimato*, which is plastered over with mud as shown in Figure 5.2. The lid is also made from sticks. *Mahangu* may last for about five years without spoilage. Before eating, *mahangu* is sieved to remove the dirt. It is then pounded and washed, before being pounded again to make *mahangu* flour which is used to cook the porridge called '*oshifima*'.

In his presentation, the Portuguese community member who is originally from the Ngangela tribe in Angola, revealed that they grow *mahangu* as well as *cassava*. Similarly to the *Oshiwambo* culture, they also store *mahangu* in a grain basket. They also apply mud and ash before putting *mahangu* in to keep it safe from insects. They keep *mahangu* for about a year. Likewise, before eating, *mahangu* is washed to remove the dirt and then pounded to make *mahangu* flour which is used for cooking porridge.

Figure 5.2: The oshimato (lid) plastered over with mud

The presentation on *muhangu* was only made by the *Oshiwambo* and Portuguese community members because the Herero and Damara people do not have *mahangu* in their cultures. Instead, the two tribes focus more on livestock farming. For instance, culturally, Damara are nomadic people who make a living through hunting and gathering food. The common food for the Damara people is *!Nara* fruit.

5.3.2 Preservation of fish

It emerged in this study that both the *Oshiwambo* and Portuguese (Ngangela) people eat fish. They explained that they prepare fish for storing by first washing it, removing the intestines and then applying salt on it before *sun drying* as highlighted by Aluga and Kabwe (2016). After fish are dried, they are stored in clay pots so that they can last longer. The pot is covered and plastered with mud. In the *Oshiwambo* culture, chilli is also sprinkled over the fish to keep if safe from insects. Before eating, the fish is washed to remove the excess salt and chilli added in the process of its preservation.

In contrast, however, it emerged that culturally the Herero and Damara people do not eat fish. They, however, do eat it now because of new developments such as living in urban area, and education has forced them to modify their style of living.

5.3.3 Preservation of milk

It emerged from this study that all four tribes do drink and eat milk in their cultures. They also explained that in the *Oshiwambo*, Ngangela, and Damara cultures, milking of cows and goats are done by men, whereas in the Herero culture, women are the ones responsible for milking the cows and goats. All four cultures, source their milk from cows and goats. They indicated that they store milk in a calabash called an *oxupa* in *Oshiwambo*. The Herero people store their milk in a container made from wood. Both cultures have their own type of plant that they add to milk to add taste, as well as to make it last longer. In the *Oshiwambo* culture, people add the roots of the *omunghudi* tree.

It emerged from this study that milk is a staple food for the Herero and Damara people. Thus, they treat it differently from the *Oshiwambo* and Ngangela people. For instance, the Herero and Damara people wait for the milk to become thick. They do this by putting milk in an *otjitenga* or calabash. Once it is there for about two days, the water settles at the top. They remove the water allowing the cream to become thick. All these tribes have a technique of shaking milk to get fat. After fat is removed, milk is stored in the calabash or in the clay pot. Milk without fat is said to last for a week without spoilage, even though it turns sour and becomes acidic.

5.3.4 Preservation of meat

It emerged from this study that all four tribes do eat meat in their cultures and source their meat from cows, goats, sheep, as well as from wild animals. The *Oshiwambo* people also eat dogs. All these cultures indicated that they sliced their meat into smaller pieces called *éedingu'* in *Oshiwambo*, applying salt on it before *sun drying*. The Portuguese community member explained that the addition of salt on the meat prevents microbes, and also helps to speed up the drying process by drawing out water from the meat. After the meat is dry, the Ovambo and Ngangela people store it a closed clay pot. In *Oshiwambo*, dried meat is also hung in the cooking hut. Apparently, the heat and soot from the fire is unfavourable to microbes. The Damara people store their meat in calabashes or in clay pots.

During these lesson presentations, my focus was on learners' reactions and responses towards the integration of IK. That included participation, interaction between the learners and community members or between learners themselves. I was also curious to know how the learners whose cultures were presented reacted to their own cultures, and the reactions of learners who did not belong to those cultures.

Data generated from the lesson presentations and journal reflections were coded to extract some episodes (see Appendix K). The common episodes were grouped to form sub-themes. The sub-themes were further grouped to develop the main themes. In Table 5.2 below, I present the themes, and the literature related to these.

Table 5.2: The themes which emerged from the data

Themes	**Literature/ Theory**
Theme: 1. Stimulation of learners' interest	
Learners' curiosity Sitting closer to the presenters Voluntarily participation	Klein (2011), Vygotsky (1978), Manzini (2000), Hofstein & Mamlok-Naaman (2011) Mavuru & Ramnarain (2017), Asheela (2017), Ogunniyi (1997)
Theme: 2. Promotion of active participation	
Courage to ask questions Willing to contribute to the lesson	Atanasoska et al., (2015), Vygotsky (1978), Manzini (2000), (2017), Oguniyi (2007), Liu et al., (2006), Agunbiade (2015), Hofstein &

Sharing information	Mamlok-Naaman (2011), Ortega (2003), Osborne et al., (2003)
Theme: 3. Learning with understanding	
Showing understanding and awareness Complementing knowledge Common understanding Relating what is learned to their context	Le Grange (2007), Aikenhead & Jegede (1999), Oloruntegbe & Ikpe (2011), Jegede (1999), Vygotsky (1978), Osborne et al., (2003), Papanastasiou & Papathanassiou, (2002), Hofstein & Mamlok-Naaman (2011), Hanson (2004), Manzini (2000), Mavuru & Ramnarain (2017)

I now discuss each of these themes below.

5.4 THEMES EMERGING FROM THE DATA

5.4.1 Stimulating learners' interest

Data from the observations revealed that learners' curiosity was stimulated by the different cultural materials from the different cultures. To be specific, when the *Oshiwambo* and Herero community members were unpacking their presentation artefacts, learners were observing curiously. Additionally, those learners who were sitting at the back of the class were observed standing to see what was being unpacked.

In the presentation by the *Oshiwambo* community member, learners, particularly those who were seated at the back of the class were observed moving from their seats to sit closer to the presenter and it could be argued that this signified their interest in the presentation.

Figure 5.3: Learners seated closer to the OCF during the presentation

Similarly during the presentation by the Portuguese community member, more learners were observed moving closer to the presenter.

Figure 5.4: Learners clustering around the PCF during the presentation

During the presentations, learners were excited. Some learners had smiles on their faces, whereas others were observed laughing. In other words, learners were showing signs of enjoying the presentations. When they were asked about what they had not enjoyed during these presentations, most learners responded by saying, "*I enjoyed everything*", suggesting a general positive attitude amongst these learners. Some learners reflected that:

> *I enjoyed everything. There is nothing I did not enjoyed because I learned a lot of new things.* (L1)
>
> *Nothing because everyone enjoyed it so much.* (L3)
>
> *I enjoyed everything.* (L2, L3, L4, L7, L10)

Learners also demonstrated their interest in the lessons through asking questions. For example, the PCM explained that cassava is prepared by first digging the roots, washing them in the river, and then drying them. L29 asked*, "Does the washing of cassava in the river not cause water pollution*"? The PCM responded that cassava is a natural plant and therefore does not cause water pollution.

Also, when the PCM explained that dried meat is stored in clay pots, L23 wanted to know, "*Apart from salt, is there anything that you apply on the meat*"? PCM replied that, "*No, it is only crystal salt"*. L14 also asked, "*Don't you apply vinegar and spices on the meat*"? The

PCM replied that, "*It was hard to get vinegar and spices those days*". L7 then wanted to know, "*Where do you get salt*?" "*We get it from the rivers*" was the PCM's response.

This two way interaction between the community member and the learners were mostly observed in the PCM's presentation. Vygotsky highlighted that learners interact freely with their peers because they feel free to ask or challenge their peers, unlike when the interaction is between the learner and an older person. It is thus assumed that the two way interaction between the PCM and the learners was because the PCM was relatively younger than the other community members.

It has been argued that learners show greater interest in learning if it is related to their socio-cultural setting (Mavuru & Ramnarain, 2017). Some learners may come to school with the assumption that school science is totally different from what they are doing at home. In other words, they are not in a position of establishing the link between school science and science at home as highlighted by Kibirige and Van Rooyen (2006). In this study, however, it seemed learners were keen and eager to see how these two bodies of knowledge are connected.

In a similar study that Manzini (2000) conducted with South African learners to establish their attitudes towards the teaching of indigenous African science, learners expressed positive feelings about science. They indicated that the integration of IK in teaching makes the lessons interesting and school science easier to understand. In addition, a study conducted by Asheela (2017) where teachers presented their lessons using easily accessible materials, teachers reported that learners were very interested in the lesson, more particularly when *oshikundu* was used.

Referring to language, signs, and physical materials, Vygotsky (1978) also emphasised that culture provides mediational cultural tools. In the context of this study, it is the cultural materials, *otjitenga* and clay pots for example, which were used by the community members during their presentations. These cultural tools were useful in mediating learning. As a result, learners were free to ask many questions.

The findings also revealed that learners actively participated during the presentations by the community members. For example, when the OCF asked "*Where do we keep mahangu which are used daily"*? L25 voluntarily stood up and explained that "*It is stored in small grain baskets*

made from palm leaves called omashungu". Similarly, during the group activity L7 volunteered to explain what cassava was and how it was prepared.

Manzini (2000) postulated that learners' everyday knowledge helps them make sense of their world, motivating them to take part in knowledge construction. Teaching which completely ignores the world view of the learners, subjects them to what Ogunniyi (1997) called 'symbolic violence'. A learner suffering from symbolic violence feels lost in the class, irritated and unsupported by the classroom context. Such learners can be observed by being quiet in class and not taking part in the lessons. Thus, Newell et al. (2015) suggest that emphasis should be put on identifying teaching approaches which increase young learners' positive attitudes towards science and to understanding aspects of these attitudes in relation to their achievements.

5.4.2 Promotion of active participation

During the lesson presentations, frequent interaction between learners and community members were observed. The *Oshiwambo* and Portuguese community members in particular, involved learners by always asking what the learners already knew. For example, before the OCF began talking about *mahangu*, she asked "*Do we all know mahangu*"? In a similar case, before the OCF explained how mahangu is produced, she asked learners "*Where do we get mahangu*"? Before the OCF stated where *mahangu* was stored, she also asked the learners "*Where do we store mahangu*"?

Learners responded actively to all these questions. In some instances, learners were observed putting up their hands, even before the presenter finished asking the question (see Figure 5.4).

Figure 5.5: Learners putting up their hands before the OCF finishes asking the question

The lesson observations also showed learners' motivation and willingness to contribute to the lessons. Learners showed this by volunteering to explain aspects which they felt were not clearly explained by others. This evidence is in the learners' reflections. For example, L8 reflected that "*I enjoyed being explained [to] by my friend"*.

The other thing which emerged was that learners showed mental involvement in the lessons. In my view, this was evidenced by how they learners asked questions. During the presentations, learners paid attention and followed what the presenter was saying. If the presenter mentioned an unfamiliar concept, they asked the presenter to explain or sometimes showed a reaction which indicated that they did not understand. When a presenter asked a question, learners provided answers immediately, unlike in some lessons where the teacher has to repeat the question before the learners provide the answer.

To Vygotsky (1978), active participation creates an environment in which all learners have the opportunity to learn as they interact socially. Since these learners come from different cultural backgrounds, the interactions also afforded them an opportunity to explore issues in-depth from different viewpoints, making the lesson interesting. Such an atmosphere promoted active participation which may ultimately lead to positive attitudes towards science.

There is a strong correlation between learners' attitudes towards science and the manner in which they are taught (Osborne et al., 2003). Aikenhead and Jegede (1999) indicated that most African learners are taught science in the western context which side-lines their African experiences, consequently they fail to see the relevance of these knowledges in fields beyond

the school. These learners do not participate, neither do they enjoy science lessons resulting in them developing negative attitudes towards science, and ending up opting to pursue careers in social and art related subjects as highlighted by Ortega (2003). It is for these reasons that Aikenhead and Jegede (1999) advocated for border crossing between home and school science.

5.4.3 Learning with understanding

The findings revealed that teaching of food preservation provides an opportunity for learners to build on their prior knowledge. For instance, when the *Oshiwambo* community member was presenting, learners where observed giving additional information to what the presenter said. For example, when she was explaining the process of preserving *mahangu*, she said, "*Shama oilya ya kukuta, ohatu kufa nee oimwati ndee hatu I denge*" (once *mahangu* is dry, we use soft sticks to thrush it); L25 continued, adding to what the presenter said, "*Noikumbwati, nomishi*" (we also use hard sticks and pestle).

Similarly, when the *Oshiwambo* community member explained that "*Shama watu omahangu, oto mono oufila wokuteleka oshifima, nokudunga oshikundu*" (after we pound *mahangu*, we get flour for cooking porridge, and making oshikundu), L17 continued, adding that "*Nokuninga okatete, noshikwiila*" (we get flour for making thick porridge and traditional bread called *oshikwiila*).

From the findings, it also emerged that the use of indigenous ways of food preservation served as prior knowledge for many learners as they were learning. For example, some *Oshiwambo* learners were observed using words or drawing conclusions from the presentation by a Portuguese community member using their cultural concepts. For instance, when the community member was demonstrating the sliced pieces of meat, L1, L12 and L20 said "*Eedinguuuuu*!" (dried meat!). In other words, as learners were learning new concepts from other cultures, they were relating them to what they knew in their own culture.

Aikenhead and Jegede (1999) highlighted that when learners learn science, they need to move from their life world culture into the culture of school science. If the teacher creates a platform which helps learners to relate and link what they are learning to what they know from home, the transition becomes easier. Vygotsky (1978) emphasised that learning is socially constructed. As learners are engaged in activity with parents, teacher or other learners, they learn new things. Some of the learners' expressions (such as when they recognised that the

sliced pieces of meats from the PCM looked like chilli bites that they bought from the shop) symbolised the smooth closing between the two borders of knowledge (Aikenhead & Jegede, 1999), and the internalisation of new knowledge. In my view, these learners are more likely to retain this knowledge for a longer period of time.

In the consolidation lesson, learners were asked by the teacher to mention some ways in which is food preserved. As learners were responding, most demonstrated a comprehensive general understanding of food preservation. Secondly, they also demonstrated conceptual understanding of key concepts, preservation and sun drying for example. As they were responding to the teacher, some were drawing both from their cultural practices and from the knowledge they gained from the expert community members. For example, many learners were able to state *sun drying,* as a method of food preservation, and it was well emphasised by all four expert community members.

In a study that Nikodemus (2017) conducted with Grade 9 learners and a community members, learners revealed that it is good to involve community members in teaching since they can teach learners some ideas which a teacher cannot do. In a similar study that Mavuru and Ramnarain (2017) conducted with Grade 9 learners at three township schools in South Africa, they found that teachers' consideration of learners' socio-cultural background in lessons provided a learning situation that promotes the development of critical thinking skills in learners. Le Grange (2007) argued that the socio-cultural background influences how learners learn new knowledge than the subject content itself. Furthermore, this finding also supports Kibirige and Van Rooyen (2006) who argued that IK and WS should not be looked at as two different knowledges that are competing. Instead, they should be used to complement each other.

5.5 ADDITIONAL FINDINGS

It emerged from this study that teaching in a multicultural class can be a challenge. Some teachers might rely on their mother tongue to clarify concepts when learners do not understand. This study has learned that it is a challenge to learners who do not speak that language. I am therefore of the view that, if code switching is to be applied, the teacher should use multi-languages to accommodate all the learners.

Additionally, the study also revealed that the personality of the presenter plays a significant role on the learners' participation. It is such a wonderful idea to involve community members, more particularly senior members, as they are rich in cultural knowledge. However, when it comes to the classroom environment, some community members might struggle to capture the learners' interest, resulting in poor participation. On the other hand, young community members are good at winning the attention of the learners, which leads to active participation and eventually positive attitudes towards their presentations. However, it is recognised that young community members might lack some cultural knowledge.

I therefore suggest that presentations which involve senior community members should consider using other environments rather than classroom, to maximise the benefits from these rich knowledges that community members possess.

5.6 CONCLUDING REMARKS

This chapter provided the presentation, analysis and discussion of qualitative data from observations and learners' reflections. The findings of the study revealed that the integration of IK in teaching science enhances active participation, which might over time ultimately lead to positive attitudes towards science. Learners learn with understanding if they are able to relate what they are learning to their everyday lives. The study also noted that in multicultural classrooms, the use of local language or code switching might only be effective if it is done through multi-languages.

In the next chapter, I present the summary of the findings, recommendations and the conclusion.

CHAPTER SIX: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

In the previous chapters (Chapters Four and Five), I presented, analysed and discussed findings from quantitative and qualitative data. Quantitative data were generated from the pre-and post-intervention questionnaires, while qualitative data were generated from a group activity, lesson observations and learners' reflections. In this chapter, I thus present a summary of my findings, recommendations, and areas for future research. Research findings were aimed at answering the following research questions:

1. What are the learners' conceptions, attitudes, and interest towards science?
2. What local knowledge or indigenous knowledge do Grade 6 learners have on the topic of food preservation?
3. How do Grade 6 learners react and respond to the presentations on traditional ways of preserving food made by the community members?
4. How do the community members' presentations on traditional ways of preserving food influence (or not) learners' conceptions and attitudes in a multicultural class?

In the next section I present the summary of the findings.

6.2 SUMMARY OF THE FINDINGS

As highlighted earlier, data were gathered and analysed to answer my four research sub-questions. I now present the summary of the findings in relation to each question.

Research question 1: What are the learners' conceptions, attitudes, and interest towards science?

As highlighted earlier in Section 4.2, a pre-intervention questionnaire was administered before the intervention to establish learners' prior conceptions, attitudes, and interest towards science. After the intervention, a post-intervention questionnaire was also administered to establish if there was a shift in learners' conceptions, attitude and interest towards science as the result of

the intervention. The results showed that prior to the intervention, most learners had low to moderate conceptions towards science. However, after the intervention, there was a positive shift in the learners' conceptions towards science to either moderate or high.

With regards to the learners' attitudes, the results before the intervention showed that most learners had low and moderate attitudes towards science, and only 6% of the learners had high attitudes towards science. However, after the intervention, there was a positive shift in the learners' attitudes towards science even though the result still showed that 6% of the learners had low attitudes towards science. My assumption is that this could in part be due to the short time the intervention was enacted.

Pertaining to interest, the results showed that more learners had low or moderate interest in science prior to the intervention. However, after the intervention, the results showed a significant positive shift from low or moderate to a high interest in science.

On the three items (conceptions, attitudes and interest) that were examined, the results showed that a high positive shift was recorded on interest, followed by conceptions, and then only a small shift was recorded on attitudes. This might be attributed to the fact that these learners were still in a foundation grade where they are in the process of learning basic science and becoming immersed in the culture of science. The same sentiment was echoed by De Witt et al. (2011) who alluded that learners make their choices about science at secondary school level. In addition, in my view, considering the period of the intervention study which was five weeks, it might not have been sufficient time to impact a significant change in learners' attitudes.

Research question 2: What local or indigenous knowledge do Grade 6 learners have on the topic of food preservation?

The data responding to this research question are also presented in Chapter Four (see Section 4.5). The results revealed that learners involved in this study had prior knowledge of different types of traditional foods. For instance, beans, wild spinach, berries and *mahangu* were commonly known traditional foods by the majority of learners in the class. Some learners were able to tell ways of preserving foods such as *mahangu* and beans, even though they could not provide explanations of what makes wood ash for instance suitable for use in *mahangu* preservation.

The results also revealed that the majority of learners were able to differentiate between traditional and modern foods. Based on the results, I however anticipate that as time goes by, most learners will find it hard to differentiate between traditional and western food and practices since most of the learners are growing up in towns where these cultural practices are hardly practised. Similar sentiments were echoed by Nyika (2017) who highlighted that indigenous knowledge is learned socially as people are in contact and engaged in cultural activities as they live and work within their communities. Thus, learners who are growing up in towns or urban areas might hardly acquire this knowledge.

Research question 3: How do Grade 6 learners react and respond to the presentations on traditional ways of preserving food made by the community members?

The data responding to this question were presented in Chapter Five (see Section 5.3). The results revealed that learners' curiosity was stimulated by different cultural materials from different cultures, particularly when the *Oshiwambo* and Herero community members were unpacking their presentation cultural artefacts. Learners observed curiously and those who were sitting at the back were observed standing to see what was being unpacked.

The results also revealed that the presentations by the community members were very interesting to these learners and they were excited. Some learners had smiles on their faces, whereas others were observed laughing. When learners were asked to reflect on the lesson presentations, most of their response were characterised by answers such as "*I enjoyed everything*". These findings resonate with Klein (2011) who argued that learners might be more interested in the lessons if they are related to their social context. It is for these reasons that Mavuru and Ramnarain (2017) drew on Vygotsky's (1978) seminal work and accentuate that it important for science to make efforts to take into consideration learners' diverse socio-cultural contexts.

The study also revealed that the teaching of food preservation afforded an opportunity for the learners to build on their prior knowledge as reiterated by Kuhlane (2011). This was observed particularly in the presentation of the *Oshiwambo* community member. For example, learners were observed giving additional information to what the presenter said. The presentation by community members from different cultural backgrounds also afforded learners an opportunity to learn some socio-cultural issues concerning food presentation from different perspectives, helping them understand and internalise new knowledge as proposed by Vygotsky (1978).

Research question 4: How do the community members' presentations on traditional ways of preserving food influence (or not) learners' conceptions and attitudes in a multicultural class?

The data responding to this research question were derived from data presented in Chapter Five. In addition, supporting evidence was also drawn from Chapter Four (see Section 4.3).

The results revealed that learners' conceptions, attitudes, and interest were positively influenced as a result of the presentations by the community members where local knowledge was integrated. Prior to the intervention however, qualitative results revealed that most learners had low or moderate conceptions, attitudes, and interest towards science. After the presentations by the community members, learners were asked to evaluate what they had learned, enjoyed or not enjoyed and to suggest how possibly the lesson could be improved. Most of the learners indicated that they enjoyed everything about the lessons as highlighted by Nikodemus (2017) and Manzini (2011). Some learners went further to suggest that the lessons could be improved by inviting or bringing in more community members. In my view, this desire of wanting to see more community members involved, symbolises a positive shift in learners' conceptions and attitudes. In the study which Klein (2011) conducted with the Nama people in Namibia, his findings also revealed that the involvement of community members in school activities does more than learners simply enjoying the lessons. In his study, both the drop-out rate and disciplinary problems in the schools were reduced.

Furthermore, after the intervention, the qualitative results also provided evidence as to how learners' conceptions and attitudes were influenced as a result of the presentations by the community members. In addition, the subject teacher also indicated that most learners showed interest in the lesson and participated actively, particularly those who do not normally participate in school lessons.

6.3 RECOMMENDATIONS

The study established that the integration of local knowledge has the potential to enhance learners' interest in lessons, and in science at large as alluded to by Klein (2011). Science is a challenging subject and this is attributed to its abstract nature (Govender, 2014). Many learners may not cope with abstract thinking, hence they regard science as difficult. Educators,

particularly teachers who do not have an interest in helping learners to succeed in science also contribute to learners concluding that science is difficult.

However, the integration of local knowledge in science teaching minimises the challenges of abstract thinking. When IK is integrated, learners are able to relate what they are learning to what they know, as alluded to by Kibirige and Van Rooyen (2006). This makes it easier for them to learn. Ogunniyi (2007) also argued that there is much science within cultural practices. This study thus recommends that local knowledge should be integrated in science lessons where possible to smooth the border crossing from home to school science as highlighted by Aikenhead and Jegede (1999).

The study is fully aware of the challenges faced by teachers as far as the integration of local knowledge is concerned. For example, a study by Asheela (2017) highlighted that teachers do not conduct practical activities using local materials because the training they receive during teacher training is more focused on using scientific materials. The study thus recommends that the concept 'indigenous knowledge' should be introduced to teachers well in advance, more particularly during their teacher training. This is to allow sufficient time for teachers to acquaint themselves with the field of IK. In addition, research has indicated that IK is not documented (Nyika, 2017); instead, it is mostly passed on from one generation to the other orally. This has made it difficult for learners to make use of these knowledges in national examinations since they might not be accepted. This study suggests that IK should be documented. In addition, the marking of national examinations for example, should be localised to accommodate and consider learners' IK and experiences.

The study also established and acknowledged the contribution of community members in science lessons. It emerged from this study that community members are rich in cultural knowledge which can be utilised with school science to enhance teaching and learning. The introduction of community members in class also created a reference memory from which the learners could draw from when they approach scientific problems. Notwithstanding, these community members might experience challenges in capturing the learners' attention if they are brought to do the presentations in the classroom space. This study thus recommends that proper planning should be made to ensure that the environment is conducive and friendly to the community members.

As Namibia is advancing, multicultural schools are likely to increase. That suggests that the challenge of teaching in multicultural classrooms expressed in literature might be the subject of the day for many Namibian teachers. The challenges of teaching in multicultural schools might further be worsened when teachers want to integrate IK in teaching. To this, this study suggests that the teacher training curriculum should be designed in such a way that it addresses these needs.

The study has also noted that the NCBE (2015) has said little about food preservation despite its potential to contribute to the economy of this country and Africa at large. De Witt et al. (2011) argued that learners' interest in science is mostly established before secondary school level. In the case of learners who aspire to be agriculturalists, their interest might increase if topics such as food preservation are well emphasised in the curriculum. To this, the study suggests that the curriculum designers should ensure that the topic of food preservation is highlighted in the national curriculum because it has the potential to contribute to the country's economy.

6.4 AREAS FOR FUTURE RESEARCH

This study has opened up opportunities for possible further research on the integration of IK in science lessons. De Witt et al. (2011) has indicated that learners' attitudes towards science is mostly established at secondary school level. I would thus recommend that upon the introduction of food preservation in the curriculum for secondary school, further research should be done on the same topic to confirm De Witt et al.'s (2011) claims. I also suggest that a future study on attitudes should be conducted over a longer period of time to properly assess the effects of integrating IK on learners' attitude.

6.5 LIMITATIONS OF THE STUDY

The limitations of this study are similar to many case studies conducted. This study was conducted with a Grade 6 class at one school. Due to the smallness of the sample, the findings of the study cannot be generalised to the whole region or country at large. However, the knowledge and insight from this study might be useful in other contexts.

This study was conducted with Grade 6 learners who are regarded as minors by the Rhodes University Ethics Policy. This has limited the study from not using questionnaires where learners could gather information regarding cultural ways of food preservation from their

communities. Instead, the study used a group activity. Initially, the study also planned to conduct interviews with individual learners, however this was still not possible because these learners were regarded as minors. The other limitation was time constraints. This study was conducted at a different school from where I teach. This school is a private school where the school programme is strictly adhered to. The study was only allocated two slots per week, of which each slot lasted for not more than one hour.

6.6 REFLECTIONS

It was an achievement pursuing my degree of Bachelor of Education with honours and my Master degree in science education with Rhodes University. My interest of furthering my studies was triggered mainly by the fact that I had a poor educational background. This was due to political instability which prevailed in the country during my primary school level years. When I was choosing an institution to study with, I considered those that offered contact sessions. Hence, I joined Rhodes University in 2015 when I registered as a post-graduate student.

Things were not easy at the beginning of 2015. There were many challenges, and language was one of those challenges which I experienced during my Bachelor of Education course. I really tried hard to cope with the accents of my lecturers, and also to understand the academic language used in journal papers. In 2016, Professor Kenneth Ngcoza introduced us to the concept of "indigenous knowledge". Lessons on IK were so interesting because they were based more on our everyday experiences, or so to say, things that we do mostly at home. This triggered my research interest because our cultures are full of practices and beliefs that are not tapped into.

My research interest began with the study on cultural beliefs about twins, and I published a short paper this year, 2018. My research topic was necessitated by the fact that, before I enrolled for my Master's degree course, I changed my duty station. I transferred from a rural school to a semi-urban school which is a multicultural school. At my former school, all learners were *Oshiwambo* speakers. As result, if I wanted to explain something which they did not understand, I used to code-switch to *Oshiwambo*. In contrast however, it became a challenge to teach at my current school since not all learners understand *Oshiwambo*. I had to strictly communicate in English. Nonetheless, this challenge gave me the idea of how to frame my research topic.

My research journey was a challenging and rewarding experience. This study was conducted at a time when Rhodes University was revising its research ethics policy. According to this policy, learners under the age of 18 years are regarded as minors. That means, all studies involving learners have to get approval both at departmental level and then from Rhodes University. I would say, this ethical policy was implemented without proper understanding even from the side of our supervisors. Hence, many students' proposals, more particularly studies with learners, could not be approved in time, causing a delay in the data generation process. In addition, this caused many students to panic and lose hope in their studies.

The research journey was, however, rewarding in the sense that all the challenges I went through were learning experiences. Secondly, this study presented me an opportunity to travel to South Africa where I learned about the people of South Africa, their culture, as well as the beauty of the country. Thirdly, this study has significantly contributed to my academic and professional growth. Through the guidance from my supervisor Prof Ken Ngcoza, I managed to publish two short papers. At the same time, I am recognised in my region due to my outstanding performance.

6.7 CONCLUSION

In this chapter, I presented a summary of the findings in relation to my research questions. The main findings of this study concluded that the integration of indigenous knowledge when teaching food preservation in a multicultural class influenced learners' conceptions, attitudes and interest positively. In their reflections, learners indicated that lessons were interesting, and enjoyable. Based on these findings, the study made some recommendations, as well as suggested areas for future research.

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APPENDICES

APPENDIX A: PERMISSION LETTER TO THE DIRECTOR

The Director of Education

Oshana Education Directorate

P O Box

Oshakati

Dear Mrs Ileni Ankana

Subject: Request for permission to conduct educational research at Suku Private School (pseudonyms) with learners in Oshana Region.

I am Fillipus Shetunyenga Shetunyenga, a part-time Master student at Rhodes University (student number: 15s8833), and a Mathematics and Science teacher at [redacted] Junior Secondary School. I am hereby humbly requesting for permission to conduct a science research study with learners at Suku Private School (pseudonyms) for five weeks in September/October 2018.

The National Curriculum requires teaching and learning to begin from a wealth of knowledge and experience gained from family, and community. However, having schools that are composed of learners from different cultural background, it becomes a challenge to teacher since each learner has his/her knowledge and experience that a teacher need to consider. Thus, this study aims to Investigating how the learners' attitude is influenced (or not) by integrating local or Indigenous Knowledge when teaching food preservation in a multicultural grade 6 class. The study is under the supervision of Prof Kenneth Ngcoza (E-mail: K.Ngcoza@ru.ac.az) and Ms Zukiswa Kuhlane (E-mail: z.kuhlane@ru.ac.za).

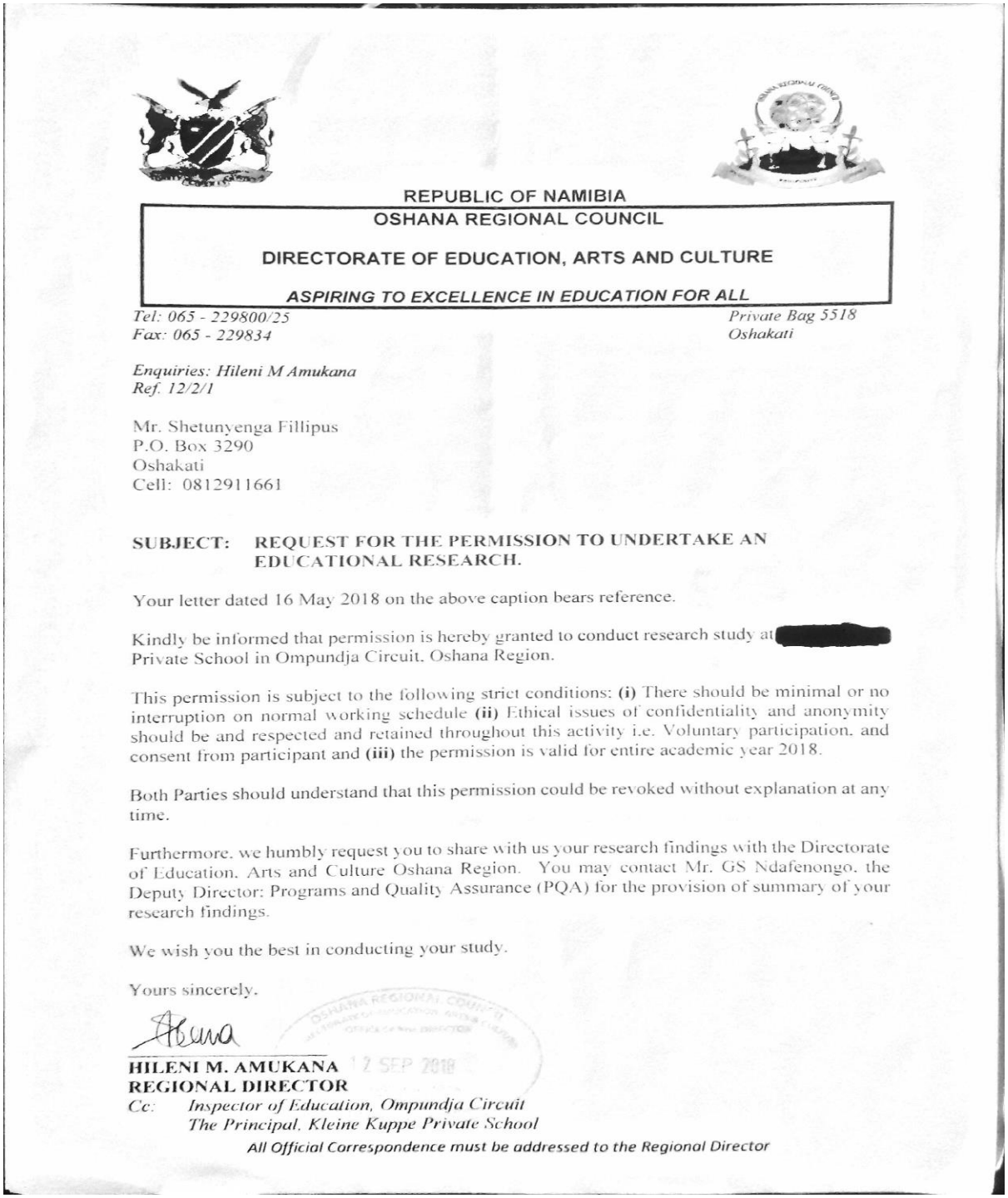
I would further like to assure your office that, should I be granted permission, the research ethics will apply throughout the process of the study. Identity of participants and their view will be treated with high degree of confidentiality and anonymity.

Thank you for your time, and your consideration in this regard will be highly appreciated.

Yours Sincerely

FS Shetunyenga (Rhodes University Student)

APPENDIX B: PERMISSION LETTER FROM THE DIRECTOR



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DIRECTORATE OF EDUCATION, ARTS AND CULTURE

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Tel: 065 - 229800/25
Fax: 065 - 229834

Private Bag 5518
Oshakati

Enquiries: Hileni M Amukana
Ref. 12/2/1

Mr. Shetunyenga Fillipus
P.O. Box 3290
Oshakati
Cell: 0812911661

SUBJECT: REQUEST FOR THE PERMISSION TO UNDERTAKE AN EDUCATIONAL RESEARCH.

Your letter dated 16 May 2018 on the above caption bears reference.

Kindly be informed that permission is hereby granted to conduct research study at [redacted] Private School in Ompundja Circuit, Oshana Region.

This permission is subject to the following strict conditions: **(i)** There should be minimal or no interruption on normal working schedule **(ii)** Ethical issues of confidentiality and anonymity should be and respected and retained throughout this activity i.e. Voluntary participation, and consent from participant and **(iii)** the permission is valid for entire academic year 2018.

Both Parties should understand that this permission could be revoked without explanation at any time.

Furthermore, we humbly request you to share with us your research findings with the Directorate of Education, Arts and Culture Oshana Region. You may contact Mr. GS Ndafenongo, the Deputy Director: Programs and Quality Assurance (PQA) for the provision of summary of your research findings.

We wish you the best in conducting your study.

Yours sincerely,

HILENI M. AMUKANA
REGIONAL DIRECTOR

Cc: Inspector of Education, Ompundja Circuit
The Principal, Kleine Kuppe Private School

All Official Correspondence must be addressed to the Regional Director

APPENDIX C: PERMISSION TO THE SCHOOL PRINCIPAL

Shetunyenga Fillipus S
P. O. Box 3290
Ongwediva
12 September 2018
Cell: 0812911661

The Principal
[redacted] Private School
P O Box
Ongwediva

Dear Sir/Madam

Re: Request for permission to conduct educational research with grade 6 learners at [redacted]

I am Fillipus Shetunyenga Shetunyenga a part-time student doing Masters in Science Education with Rhodes University, South Africa and a Mathematics and Science teacher at [redacted] Junior Secondary School, hereby humbly request your permission for me conduct a research study with learners at [redacted]. The purpose of the study is to investigate the learners' attitude when local or indigenous knowledge is integrated in teaching in a multicultural class.

The study is in line with the National Curriculum which requires teaching and learning to begin from a wealth of knowledge and experience gained from family, and community. However, having schools that are composed of learners from different cultural backgrounds, it becomes a challenge to teach since each learner has his/her knowledge and experience that a teacher needs to consider. Thus, this study aims to establish the learners' attitude when these knowledge is integrated. The study is under the supervision of Prof Kenneth Ngcoza (E-mail: K.Ngcoza@ru.ac.az) and Ms Zukiswa Kuhlane (E-mail: z.kuhlane@ru.ac.za).

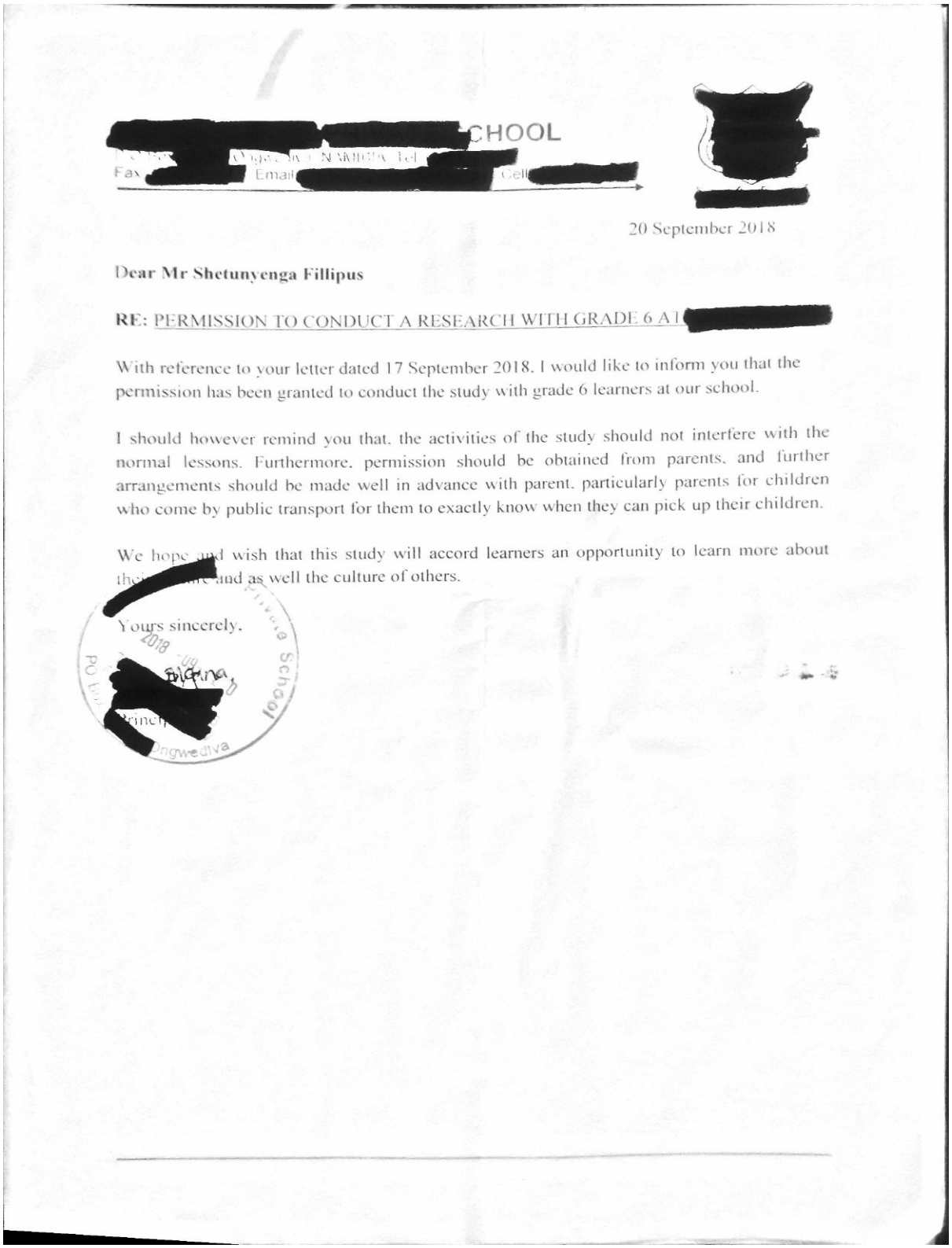
I would further like to assure your office that, should I be granted permission, the research ethics will apply throughout the process of the study. Identity of participants and their view will be treated with high degree of confidentiality and anonymity.

Your consideration in this regard will be highly appreciated.

Yours Sincerely

FS Shetunyenga (Rhodes University Student)

APPENDIX D: PERMISSION FROM THE SCHOOL PRINCIPAL



[redacted] SCHOOL

[redacted]

20 September 2018

Dear Mr Shetunyenga Fillipus

RE: PERMISSION TO CONDUCT A RESEARCH WITH GRADE 6 AT [redacted]

With reference to your letter dated 17 September 2018, I would like to inform you that the permission has been granted to conduct the study with grade 6 learners at our school.

I should however remind you that, the activities of the study should not interfere with the normal lessons. Furthermore, permission should be obtained from parents, and further arrangements should be made well in advance with parent, particularly parents for children who come by public transport for them to exactly know when they can pick up their children.

We hope and wish that this study will accord learners an opportunity to learn more about th[redacted] and as well the culture of others.

Yours sincerely,

[redacted]

Principal

Private School

Engwedlva

APPENDIX E: PERMISSION LETTER TO THE PARENTS

Enquiries: Mr Fillipus SS
Cell number: 0812911661
Dear Parent

Re: Participation in research on the integration of local or Indigenous Knowledge when teaching in food preservation in a multicultural class.

I am Fillipus Shetunyenga Shetunyenga, a part-time student doing Masters in Science Education with Rhodes University, South Africa and Mathematics and Science teacher at Ongwediva Junior Secondary School. I hereby humbly request your permission for me to conduct a research study with your child who is schooling at [redacted] Private School. The focus of the study is to investigate the learners' attitudes when local or indigenous knowledge is integrated in teaching in a multicultural class. I plan to conduct the study for about four weeks in September/October 2018.

The study will require learners discuss traditional food and how they are preserved on their community. This will be followed by a questionnaire on cultural ways of food preservation. Two lessons on preservation of Mahangu, fish, meat and milk will be presented by four community member while I am observing and video recording. Information from questionnaire and video recording will be analysed to establish their attitude towards indigenous knowledge. All these activities will be conducted twice a week after school, therefore parents are requested to make means for learners not to miss this golden opportunity to learner about their culture and others' cultures too.

Kindly be informed that participation in this study is voluntary. It is therefore the right of the parent to decide whether his/her child should participate or not. Also, participants are free to withdraw any time as they wish to do so. The identity of participants and their views will be treated with high degree of confidentiality and anonymity, and data collected will not be used for other purposes other than this study.

If you have any question about the research, please feel free to contact me at 0812911661, she2ongwediva@gmail.com or my supervisors Prof Ngcoza at k.ngcoza@ru.ac.za and Ms Zukiswa Kuhlane, z.kuhlane@ru.ac.za. Lastly, if you agree for your child to participate in this research, please complete the consent form below.

I ……. (full name of parent/guardian), hereby confirm that I understand the content of this document and the nature of the research. I hereby give permission to …… (name of the child) to participate in the study.

Yours Sincerely

FS Shetunyenga

APPENDIX F: PERMISSION LETTER TO COMMUNITY MEMBERS

Enquiries: Mr Fillipus SS
Cell number: 0812911661

Dear sir/Madam

PERMISSION LETTER: DEMONSTRATION OF FOOD PRESERVATION

I am Fillipus Shetunyenga Shetunyenga, a part-time student doing Masters in Science Education at Rhodes University, South Africa. I am a Mathematics and Science teacher at [redacted] Junior Secondary School. I hereby humbly request your permission to be a research participant in my research project that I will be conducting with grade 6 learners at [redacted] private school. The focus of the study is to investigate the learners' attitudes when integrating local or indigenous knowledge on food preservation in a multicultural class. I plan to conduct the study for about four weeks in September/October 2018.

The study will require learners discuss traditional food and how they are preserved on their community. This will be followed by a questionnaire on cultural ways of food preservation. Four community members will be selected from the culture present in the class (one per culture), who will come and do demonstration on preservation of Mahangu, fish, meat and milk while I am observing and video recording. In other words, your role will be demonstrate how you preserve Mahangu, fish, meat and milk in your culture. The presentation will be done in two days, two presenter per day. Information from questionnaire and video recording will be analysed to establish learners' attitude towards indigenous knowledge. All these activities will be conducted twice a week after school for one hour. Therefore parents will be requested to make means for learners to come learn from you, the more knowledgeable one as argued by Vygotsky (1978).

Your participation in this research study is completely voluntary and you can withdraw at any time you wish. I will ensure that your identity will be treated with high degree of confidentiality and anonymity.

I henceforth request you to indicate your choice by making a (√) in an appropriate box below.

Agree ☐

Not agree ☐

Signature: ……

Your cooperation will be highly appreciated

Yours Sincerely

FS Shetunyenga

APPENDIX G: PRE /POST-INTERVENTION QUESTIONNAIRE

WHAT DO YOU THINK ABOUT SCIENCE?

Pre/post-intervention questionnaire

This survey is completely confidential and your participation is voluntary.

Gender: Male _____ Female _____ Culture: (Oshiwambo, Herero, Caprivian)._____

Number/name:_____

Please indicate your level of agreement with each of the following statements by putting a cross (X) in your best response.

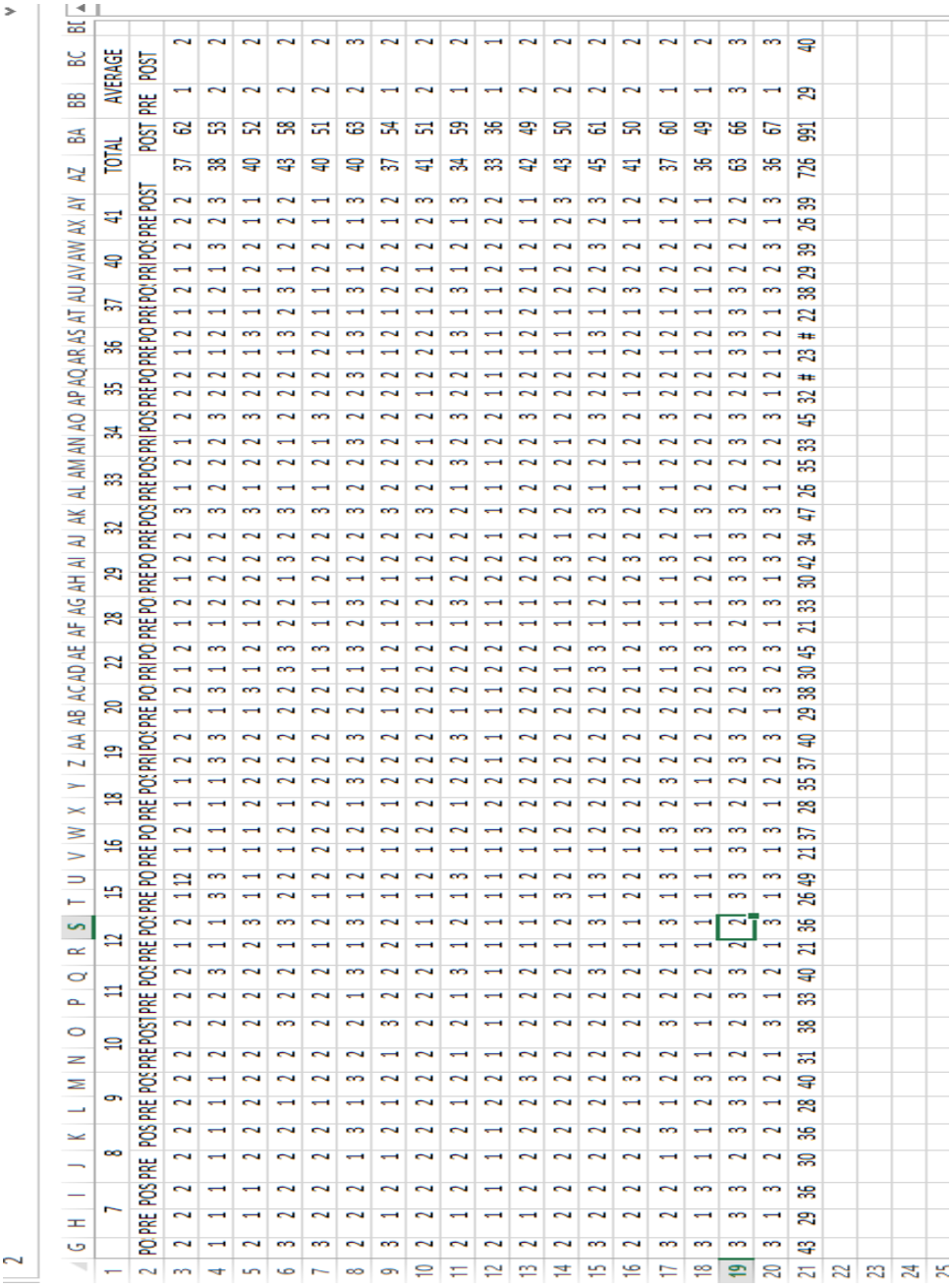
	ITEMS	**RESPONSE**				
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1	Even though science is regarded as a difficult I am sure I can understand it.					
2	I am not confident about understanding difficult science concepts.					
3	I am sure I can do well in science tests.					
4	No matter how much effort I put in, I cannot learn science with understanding.					
5	When science activities are too difficult, I give up or do the easy parts					
6	When science activities are too difficult, I do not give up.					
7	During science activities I prefer to ask other people for the answer rather than think for myself.					
8	During science activities I prefer think for myself first rather than ask other people.					
9	When I find science content knowledge difficult, I do not try to learn it.					
10	When I find science content knowledge difficult, I try to learn it.					
11	When learning new science concepts, I attempt to understand them.					
12	When learning new science concepts, I try to memorize them.					
13	When learning new science concepts, I connect them to my previous experiences.					
14	When I do not understand a science concept, I find relevant resources that will help me.					
15	When I do not understand a science concept, I discuss it with the teacher to clarify my understanding.					
16	When I do not understand a science concept, I discuss it with other learners to clarify my understanding.					
17	During the learning process, I attempt to make connections between the concepts that I learn.					
18	When I make a mistake, I try to find out why.					

19	When I make a mistake, I give up easily.					
20	When I meet science concepts that I do not understand, I still try to learn them.					
21	When new science concepts that I have learned do not agree (conflict) with my previous understanding, I try to understand why.					
22	When new science concepts that I have learned do not agree (conflict) with my previous understanding, I give up.					
23	I think learning science is important because I can use it in my daily life					
24	I think learning science is important because it stimulates my thinking					
25	Science is important for our daily lives.					
26	I think it is important to participate in inquiry/investigative activities in science.					
27	It is important to have the opportunity to satisfy my own curiosity when learning science.					
28	I participate in science class only to get good marks.					
29	I participate in science class to perform better than other students.					
30	I participate in science class so that other students think I am smart.					
31	I participate in science class so that the teacher pays attention to me.					
32	During a science class, I feel most fulfilled/happy when I attain a good score in a test.					
33	I feel most fulfilled when I feel confident about the content knowledge in a science.					
34	During a science class, I feel most fulfilled/happy when I am able to solve a difficult problem.					
35	During a science class I feel most fulfilled/happy when the teacher accepts my ideas.					
36	During the science class I feel most fulfilled/happy when other students accept my ideas.					
37	I like working alone in science class.					
38	Science open doors for job opportunities.					
39	Our country needs scientists to improve people's lives.					
40	The way science is taught at school is boring.					
41	I sometimes have a negative attitude towards science.					
42	I would like to understand more about scientific explanations for things.					
43	I would like to study science more deeply than I do now.					
44	I will seriously consider doing a career in science after I leave school.					
45	I like learning new things and being involved.					

APPENDIX H: SUMMARY OF LEARNER'S RATING ON CONCEPTIONS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1		1		2		4		24		25		27		30		31		38		39		TOTAL		AVERAGE		
2	Learners	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	
3	L1	1	3	2	2	1	1	3	3	1	3	1	2	1	1	2	3	2	2	1	3	15	23	2	2	
4	L2	2	3	1	3	1	2	1	3	3	3	1	2	1	3	2	3	1	3	1	3	14	28	1	3	
5	L3	2	2	2	2	1	2	2	2	1	3	1	3	1	2	1	2	2	3	2	2	15	23	2	2	
6	L4	2	3	2	2	3	3	3	3	2	3	2	2	3	3	3	2	2	3	2	2	24	26	2	3	
7	L5	3	3	2	3	1	1	2	3	2	3	2	2	1	2	1	2	2	3	1	2	17	24	2	2	
8	L6	2	3	1	3	1	3	2	2	3	3	1	3	2	3	3	3	2	3	2	3	19	29	2	3	
9	L7	2	2	1	3	1	1	1	2	1	3	1	1	1	2	2	3	1	3	1	3	12	23	1	2	
10	L8	2	3	2	2	3	3	3	3	3	3	2	3	2	2	3	3	2	3	3	3	25	28	3	3	
11	L9	1	3	1	3	2	3	1	3	1	3	2	3	1	3	1	3	1	3	3	3	14	30	1	3	
12	L10	2	3	1	2	2	2	1	2	3	3	2	3	2	2	3	2	2	2	2	3	20	24	2	2	
13	L11	2	2	2	3	2	3	2	2	1	3	3	3	1	2	2	3	2	3	3	3	20	27	2	3	
14	L12	2	2	2	3	2	3	2	3	2	3	2	3	1	3	1	2	2	3	2	2	18	27	2	3	
15	L13	2	2	2	3	2	2	2	3	2	2	1	2	2	3	1	3	1	2	2	2	17	24	2	2	
16	L14	1	3	2	3	1	3	3	3	3	3	2	2	1	3	1	3	1	3	3	3	18	29	2	3	
17	L15	1	3	2	2	1	3	2	3	1	3	2	3	1	2	1	3	2	3	1	3	14	28	1	3	
18	L16	2	2	2	2	2	3	3	2	1	2	2	3	1	2	3	2	2	3	1	3	19	24	2	2	
19	L17	2	3	3	3	2	2	3	3	3	3	2	3	2	2	2	3	3	3	3	3	25	28	3	3	
20	L18	1	2	2	3	2	2	1	3	1	3	2	2	1	3	1	1	2	3	1	3	14	25	1	3	
21		32	47	32	47	30	42	37	48	34	52	31	45	25	43	33	46	32	51	34	49	320	470	32	47	
22																										
23																										
24																										

APPENDIX I: SUMMARY OF LEARNERS' RATING ON ATTITUDES



APPENDIX J: SUMMARY OF LEARNERS' RATING ON INTEREST

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1		13		14		17		21		23		26		42		43		44		45		TOTAL		AVERAGE		
2	Learners	PRE	POS	PRI	POS	PRE	POS	PRI	POS	PRE	PO	PRI	POS	PRE	POST	PRE	POS	PRE	POST	PRE	POS	PRE	POST	PRE	POST	
3	L1	2	2	1	3	1	3	1	3	1	3	1	2	1	3	2	3	1	1	2	3	13	26	1	3	
4	L2	1	3	1	2	2	2	2	2	1	3	1	2	2	3	1	1	1	3	1	3	13	24	1	2	
5	L3	2	3	2	3	2	3	1	3	3	3	1	2	1	2	1	2	1	2	3	3	17	26	2	3	
6	L4	1	1	1	3	1	2	2	3	3	3	1	3	1	3	1	3	1	2	2	3	14	26	1	3	
7	L5	2	3	2	2	1	2	1	3	3	3	1	3	2	2	1	3	1	3	2	3	16	27	2	3	
8	L6	1	3	1	3	2	3	2	2	3	3	2	3	2	3	2	2	2	3	2	3	19	28	2	3	
9	L7	2	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	2	3	1	3	12	30	1	3	
10	L8	2	3	1	3	1	2	2	2	3	3	2	3	1	2	1	3	2	2	1	2	16	25	2	3	
11	L9	1	3	1	3	2	2	1	3	1	3	1	3	1	3	2	3	1	2	1	3	12	28	1	3	
12	L10	1	2	2	3	1	2	2	2	1	3	1	2	1	2	1	2	1	3	1	3	12	24	1	2	
13	L11	2	3	1	3	2	2	1	2	3	3	2	3	2	3	1	2	1	2	3	3	18	26	2	3	
14	L12	1	3	3	3	2	3	2	3	3	3	2	2	1	2	1	2	1	1	1	2	17	24	2	2	
15	L13	1	2	2	3	1	3	1	2	2	3	2	3	1	2	2	3	1	2	2	3	15	26	2	3	
16	L14	2	3	1	2	2	2	2	3	3	3	3	3	1	3	1	3	1	3	2	3	18	28	2	3	
17	L15	1	2	2	3	1	3	1	2	3	3	3	3	2	3	1	3	1	2	2	3	17	27	2	3	
18	L16	2	3	1	2	2	2	2	2	3	3	1	2	3	3	2	2	2	3	2	2	20	24	2	2	
19	L17	2	2	2	3	3	3	2	2	3	3	3	3	3	3	2	3	2	2	3	3	25	27	3	3	
20	L18	2	2	1	3	1	2	1	1	2	3	1	3	1	3	1	3	1	3	2	3	13	26	1	3	
21		28	46	26	50	28	44	27	43	42	54	29	48	27	48	24	46	23	42	33	51	287	472	29	47	
22																										

APPENDIX K: GENERATING SUB-THEMES FROM DESCRIPTION OF MARKED TEXT

Description of marked text	Sub-themes	Data source
is other things they apply other than salt. "don't you apply vinegar and spices on the meat"? "were do you get salt"?	Asking questions	Observation
"wanted to explain more about cassava". I enjoyed listening to those who presented something about their groups and those who acted for thanks like Esther.	Sharing information/contribution	Observation/Reflection
we harvest mahangu, we take them to *oshipale* were we thrush the cob to have mahangu. "*and we thrush them*", one learners says at the background. " We thrust mahangu with...says Mrs Rossi, the learners continued, "*with stich, and pounding sticks"*. the presentations helped me to understand what preservation is". "And I also know different ways of food preservation". I enjoyed when all of us when we did the group work and people were telling us their traditional food I enjoyed everything there is nothing I didn't enjoyed because	Showing understanding /awareness	Observation/ reflection
took mahangu and show to the class Ash is also added to prevent insects from entering, one oshiwambo learner asked, "*just like in oshiwambo*".		Observation

one learners asked, “does washing cassava in the liver not contribute to water pollution”?… some oshiwambo learners says “eedinguuuuu!”, while some learners says, “ohoooo….chilli bites”	Relating to what they know/complementing	
As she was demonstrating, some oshiwambo speaker were also imitating her with their hands up She explain by drawing on the chalk board, and later showed on the poster of one of the group. “Ohoooo….,” says the Shona speaking learner. learners were seen nodding their head, comparing how it is done in their culture. “So we are almost doing the same thing neh?”!	Common understanding	Observation
by asking learners if they all know mahangu of which many She ask if there is anyone who knows where we store mahangu. All most the whole class put up their hands. It was fun so they is nothing to be improved but the noise was too much	Elicitation/participation	Observation/Reflection
Since the cards were many, I asked learners to help with distributing. Two learners quickly volunteered to help me.	Voluntarily participation	Observation
Learners were eager to see what is in her box as she was unpacking her presentation aid. Some learners were observed moving to sit closer to the presenter. I have enjoyed the Oshiwambo group	Curiosity/telling other to keep quite / seating closer	Observation/Reflection