

**Mediating learning of sound through cultural music and dance
stories to Grade 4 farm school learners**

A thesis submitted in fulfilment of the requirements for the degree

Of

MASTER OF EDUCATION

(Science Education)

In the

Education Department

Rhodes University

By

Hlengiwe Tshitshi

Supervisor: Prof Kenneth Mlungisi Ngcoza


Co-supervisor: Mr Alfred Khumbulani Mapfumo

February 2024

Declaration of Originality

I Hlengiwe Tshitshi (17T4378), declare that this thesis has not been submitted for a degree in any other university apart from Rhodes University and I declare that it is my work, written in my own original words. It has only been submitted for the degree of Masters (Science Education) at Rhodes University. Where I have cited the words or ideas of other researchers, these have been acknowledged using complete references according to the Departmental guidelines.

Signature:



Date: February 2024

Dedication

I dedicate this thesis to the Almighty God, who has given me the strength and wisdom to carry on this study in this difficult time. My classmates at Rhodes and my mom Nomalanga (Mandela) without you I would not been here, your hard work is appreciated.

Acknowledgements

I would like to thank God who has sustained me throughout this difficult journey and has enabled me to reach the end.

I would like to thank my supervisor, Prof Kenneth Ngcoza, whose guidance and assurance never let me down. At multiple times, his encouragement gave me the strength to continue this journey. His words and comments deserve much thanks. He is passionate about ensuring the success of his learners and his commitment to this process was unwavering. I will always appreciate the invaluable feedback you provided. Your patience is beyond and highly appreciated, may God protect you in all aspects of life. Thank you, Mthembu, Gxarha!

Additionally, I would like to thank my co-supervisor, Mr Alfred Mapfumo for his support throughout the study. I would not have done this without you Mpfu. Having you and Mthembu as my supervisors I consider myself fortunate as you are the most humane and critical advisors. Your suggestions and encouragement made this thesis a success. Moreover, Dr Chrispen Mutanho your assistance and ongoing encouragement throughout the study is appreciated. *Kuwe Ndlovu ndibamba ngazo zozibini!* You had faith in me throughout this journey.

To the District Director of Sarah Baartman and the SMT of Siyolise Combined School (pseudonym), I sincerely thank you for giving me permission to conduct this study. Without your permission this research would have not taken place. I am very grateful too for the support received from my colleagues. I am particularly grateful to my former principal, Thangana. Your encouragement and support from the onset gave me a very helpful forte which strengthened me to further my studies. Special thanks to MaNkala, your support as a critical friend is highly appreciated. Your commitment throughout the study was amazing. Special thanks to my learners and their parents who made this study a success. Your support is highly appreciated. To my four Indigenous Knowledge Custodians *ndithi maz'enehole kuni* for availing yourselves. You opened your house to strangers, and shared stories with us we are forever grateful for everything. Thank you for the knowledge you shared with us.

My husband Mxolisi Duma deserves tremendous credit for allowing me hours of time and holidays away from the family to work. I know without your love and compassion none of this could have come to fruition. My children Lwandle and Ngcebo, thank you for understanding when I neglected and left you alone during my studies. God bless you all!

Finally, I would like to thank Ms Nikki Watkins for professionally editing and formatting my thesis. God bless you!

Abstract

The current South African Natural Science and Technology (NS-Tech) curriculum for grades 4–9 encourages teachers to integrate Indigenous Knowledge (IK) into their teaching. By doing so, it is hoped that this would contextualise and make science relevant to learners. However, the contradiction is that IK is hardly discussed in the curriculum and there are no clear guidelines on how to integrate it. It is against this background that in this study I used *stories* about cultural beliefs and practices on traditional music and dance to support Grade 4 NS-Tech from a farm school talking about and making sense of the topic of sound.

This study is underpinned by the interpretivist and Indigenous research paradigms. Within the Indigenous research paradigm, I focused on the Ubuntu perspective. A qualitative case study research design was employed, and the study was conducted in the Sarah Baartman District of the Eastern Cape. Four Grade 4 learners and four Indigenous Knowledge Custodians who were all family members were participants in this study. In addition, I invited an NS-Tech teacher to be my critical friend in this study. A focus group interview (sharing circle), participatory and lesson observations and learners' journal reflections were employed to gather data. Vygotsky's sociocultural theory together with Ogunniyi's contiguity argumentative theory were used as lenses to analyse data. A thematic approach to data analysis was employed to come up with sub-themes. Thereafter, common sub-themes were subsequently combined to form themes.

The findings of this study revealed that the following factors can significantly enable/constrain the ability of Grade 4 Natural Sciences and Technology learners from a farm school to comprehend and engage with the topic of sound: (1) integration of IK into science lessons, (2) Experiential learning through hands-on activities, (3) Community involvement in knowledge acquisition, and (4) Emotional effect of loud sounds. In addition, the contribution of Indigenous Knowledge Custodians facilitated a notable enhancement in learners' dialogue and understanding of sound.

Keywords: Natural Sciences and Technology; Sound; Indigenous Knowledge; Traditional Music and Dance; Storytelling; Sociocultural Theory; Contiguity Argumentative Theory

Table of Contents

Declaration of Originality	ii
Dedication	iii
Acknowledgements	iv
Abstract	vi
Table of Contents	vii
List of Figures	xiv
List of Tables	xv
Abbreviations and/or Acronyms	xvi
CHAPTER ONE: SITUATING THE STUDY	1
1.1 Introduction.....	1
1.2 Background of the Study	2
1.3 My Life History – Situating Myself in the Study	5
1.4 My Positionality and Reflexivity in the Study.....	7
1.5 Statement of the Problem.....	8
1.6 Rationale and Significance of My Study	8
1.7 Research Goal and Research Questions.....	10
1.8 Theoretical and Analytical Frameworks	11
1.9 Data-Gathering Methods.....	12
1.10 Definition of Key Concepts	13
1.11 Thesis Outline	14
1.12 Chapter Summary	15
CHAPTER TWO: LITERATURE REVIEW	16
2.1 Introduction.....	16

2.2 Sound and Movement	17
2.3 Learners' Prior Everyday Knowledge	19
2.4 What is Indigenous Knowledge?	20
2.5 Indigenous Knowledge in South African Science	22
2.6 The Need for the Integration of IK in Science Lessons.....	23
2.7 Storytelling in Science Learning.....	24
2.8 Challenges.....	25
2.9 Advantages of Integrating Indigenous Knowledge into Science.....	25
2.10 Role of Community Members in Science Classrooms	26
2.11 Hands-on Practical Activities and Visualisation.....	27
2.12 The Role of Language in Learning Science.....	28
2.13 Learner Talk and Sense Making	29
2.14 Chapter Summary	30
CHAPTER THREE: THEORETICAL FRAMEWORK	31
3.1 Introduction.....	31
3.2 Vygotsky's Sociocultural Theory	31
3.2.1 Mediation of learning.....	32
3.2.2 Culture and language	33
3.2.3 Social interactions.....	33
3.2.4 Zone of proximal development.....	34
3.2.5 Double stimulation.....	34
3.3 Ogunniyi's Contiguity Argumentative Theory.....	35
3.4 Chapter Summary	37
CHAPTER FOUR: RESEARCH METHODOLOGY.....	38
4.1 Introduction.....	38
4.2 Paradigms.....	39

4.2.1 Interpretivist paradigm.....	39
4.2.2 Indigenous research paradigm	40
4.3 Research Design.....	41
4.3.1 Qualitative Case Study.....	42
4.3.2 Research Goal and Research Questions.....	43
4.3.2 Methodological Approaches	43
4.3.4 Research site and sampling.....	46
4.3.5 Data-gathering methods	50
4.3.5.1 Group activities	50
4.3.5.2 Participatory observations and videotaping.....	53
4.3.5.3 Focus group interview (sharing circles).....	54
4.3.5.4 Journal reflections	55
4.4 Data Analysis	56
4.5 Validity and Trustworthiness	56
4.6 Ethical Considerations	57
4.6.1 Respect and dignity.....	57
4.6.2 Transparency and honesty	58
4.6.3 Accountability and responsibility	58
4.6.4 Integrity and academic professionalism.....	59
4.7 Chapter Summary	59
CHAPTER FIVE: GROUP PRESENTATIONS AND PRESENTATIONS BY INDIGENOUS KNOWLEDGE CUSTODIANS	61
5.1 Introduction.....	61
5.2 Summary of Qualitative Data Generated During the Group Activity	61
5.3 Learners' Perceptions of Indigenous Knowledge and Science.....	65
5.4 The Interplay of Cultural Practices and Scientific Understanding	65

5.4.1 Cultural narratives relating to sound.....	65
5.4.2 Practical understanding of sound through local instruments	66
5.4.3 Bridging cultural practices with scientific concepts	67
5.5 Community Engagement and Multigenerational Learning.....	69
5.5.1 Role of Indigenous Knowledge Custodians.....	69
5.5.2 Transmission of cultural knowledge through family narratives	70
5.5.3 Community presentations as learning opportunities.....	71
5.6 Learners' Engagement with Science Through Indigenous Knowledge Narratives .	73
5.6.1 The influence of Indigenous Knowledge narratives on learner engagement.....	73
5.6.2 Learners' responses to Indigenous Knowledge integration into the science curriculum	74
5.6.3 Cognitive associations between school science and home/community knowledge	74
5.7 Challenges and Opportunities in Integrative Pedagogy	75
5.8 Themes Arising from Data Analysis.....	76
5.8.1 Theme 1: Relevance of Indigenous knowledge to science education	77
5.8.1.1 Using local knowledge as an educational resource.....	77
5.8.1.2 Making science accessible and relevant	77
5.8.2 Theme 2: Pedagogical implications of IK integration	78
5.8.2.1 Enhancing conceptual understanding through cultural contexts	78
5.8.2.2 Challenges in bridging epistemological divides	79
5.8.3 Theme 3: Learner engagement and sense-making.....	80
5.8.3.1 Learner talk as a tool for cognitive development.....	80
5.8.3.2 Active learning through cultural participation	81
5.8.4 Theme 4: Community as a Source of Science Learning.....	81
5.8.4.1 The educational value of indigenous knowledge custodians	81
5.8.4.2 Intergenerational transmission of knowledge	82

5.8.5 Theme 5: The Role of Language in Science Learning	82
5.8.5.1 Encountering scientific vocabulary through indigenous knowledge	83
5.8.5.2 Bilingual education as a means of conceptual mastery	83
5.9 Implications for Teaching and Learning.....	84
5.9.1 Addressing the linguistic and cultural needs of learners	84
5.9.1.1 Integrating IK to foster a conducive learning environment.....	85
5.9.1.2 Future directions for curriculum development	85
5.10 Chapter Summary	86
CHAPTER SIX: LESSON OBSERVATION, FOCUS GROUP INTERVIEWS AND LEARNERS JOURNAL REFLECTIONS.....	88
6.1 Introduction.....	88
6.2 Themes That Emerged from Lesson Observations.....	89
6.2.1 Theme 1: Enhanced learning experience through integration of IK into science...92	
6.2.2 Theme 2: Experiential learning through practical and hands-on activities.....95	
6.3 Themes That Emerged from the Focus Group Interview (sharing circle).....96	
6.3.1 Theme 1: Integration of Indigenous knowledge into science lessons.....98	
6.3.2 Theme 2: Community involvement in knowledge acquisition..... 100	
6.4 Themes That Emerged from Learners’ Reflective Journals	101
6.4.1 Theme 1: Cultural sound and instrument knowledge	101
6.4.2 Theme 2: Integration of Indigenous knowledge into modern science..... 102	
6.4.3 Theme 3: Community engagement and involvement..... 103	
6.4.4 Theme 4: Emotional impact of loud sounds	104
6.5 Comparative Analysis	105
6.6 Chapter Summary	107
CHAPTER SEVEN: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION	109

7.1 Introduction.....	109
7.2 Summary of the Findings.....	109
7.2.1 Research questions 1	109
7.2.2. Research question 2	110
7.2.2.1. Enabling understanding through cultural expertise	111
7.2.2.2 Constraints in integrating cultural expertise	111
7.2.3 Research question 3 (a and b)	112
7.2.3.1 The integration of Indigenous knowledge into science education.....	112
7.2.3.2 Experiential learning through hands-on activities	113
7.2.3.3 Community involvement in knowledge acquisition	114
7.2.3.4 Emotional impact of loud sounds	115
7.4 New Knowledge.....	116
7.5 Limitations	116
7.6 Recommendations for Future Research	117
7.7 My Reflections.....	119
7.8 Conclusion	121
References	123
Appendices.....	139
APPENDIX A: Ethical Clearance	139
APPENDIX B: Letter to the Eastern Cape Department of Education.....	140
APPENDIX B2: Letter to the Principal of Riebeeck East Combined School	142
APPENDIX B3(a): Letter to the Natural Sciences Teacher (Critical Friend).....	144
APPENDIX B3(b): Natural Sciences teacher (critical friend) Informed Consent Letter ..	146
APPENDIX B4(a): Letter to the Community Members.....	149
APPENDIX B4(b): Translation	151
APPENDIX B5(a): Letter to the Parent(S) / Guardian(S)	153

APPENDIX B5(b): Translation	155
APPENDIX B6(a): Letter to the Learner.....	157
APPENDIX B(b): Translation	159
APPENDIX B(c): Child Participant’s Assent Form.....	160
APPENDIX C: Proposed Time Frame	166
APPENDIX D: Data-gathering Methods.....	167
APPENDIX E: Focus Group Interview Schedule	168
APPENDIX F: Group Activity	169
APPENDIX G: Observation Schedule (adapted from Nikodemus, 2017)	170
APPENDIX H: Journal Reflections Instruction: Answer all the following questions	172
APPENDIX I: Focus Group Interview Schedule.....	173
APPENDIX J: Learners’ Journal Reflections.....	176
APPENDIX K: Learners’ matching activity column A with column B	177

List of Figures

Figure 5.1: MG discussing	62
Figure 5.2: MG presenting	62
Figure 5.3: MG response.....	63
Figure 5.4: GG discussing.....	63
Figure 5.5: GG presenting.....	63
Figure 5.6: GG response	63
Figure 5.7: Learners learning to play <i>Inkinge</i>	67
Figure 5.8: MamMcirha fixing <i>Uhadi</i>	68
Figure 5.9: MamMcirha and her grandson demonstrating how to play musical instruments..	70
Figure 5.10: MamCirha dancing for the learners	71
Figure 5.11: Learners writing in their exercise books	72
Figure 5.12: Learners dancing for IKC members	73
Figure 6.1: During lesson observations	89
Figure 6.2: An example of a learner’s mind map	90
Figure 6.3: Shows learners’ writing activity	91
Figure 6.4: Learner practical activity	91
Figure 6.5: Reflecting on lesson observation with my critical friend after the lesson.....	94
Figure 6.6: Showing the sharing circle under a tree	97

List of Tables

Table 4.1: Profile of Grade 4 NS-Tech learners	48
Table 4.2: Profile of the Indigenous Knowledge Custodians	49
Table 5.1: Keys and pseudonyms used in data discussion.....	62
Table 5.2: Their responses are recorded below	64
Table 6.1: Data-gathering tools and codes used in data discussion of data in this section.....	89
Table 6.2: Themes that emerged from lesson observations.....	92
Table 6.3: Themes that emerged from the focus group interview	98
Table 6.4: Themes that emerged from learners' reflective journals.....	101
Table 6.5: Integration of findings	106

Abbreviations and/or Acronyms

CAPS:	Curriculum Assessment Policy Statements
CAT:	Contiguity Argumentation Theory
DAIM:	Dialogical Argumentation Instructional Model
DBE:	Department of Basic Education
DOE:	Department of Education
IKCs:	Indigenous Knowledge Custodians
IK:	Indigenous knowledge
IKS:	Indigenous Knowledge Systems
MKO:	More Knowledgeable Other
NCS:	National Curriculum Statement
SAARMSTE:	Southern African Association for Research in Mathematics, Science, and Technology Education
TIMSS:	Trends in Mathematics and Science Study
TSPCK:	Topic-Specific Pedagogical Content Knowledge
UNESCO:	United Nations Educational, Scientific and Cultural Organization
ZPD:	Zone of Proximal Development

CHAPTER ONE: SITUATING THE STUDY

1.1 Introduction

The study delineates a crucial inquiry into the integration of Indigenous Knowledge (IK) into the science curriculum, particularly focusing on the teaching of sound through cultural music and dance narratives to Grade 4 learners in a farm school setting in South Africa. This exploration emerges from a backdrop of observed educational challenges faced by African learners from socio-economically disadvantaged backgrounds. These challenges, as highlighted in the study, are intricately linked to the nuances of teaching science in non-western contexts, a situation that becomes particularly pronounced in the South African educational landscape.

This study draws attention to the consistent underperformance of South African learners in science and mathematics, as evidenced by their results in the Trends in International Mathematics and Science Studies (TIMSS) (Mupira & Ramnarain, 2018; Mutambara & Bayaga, 2020). It could be surmised that a significant factor contributing to this underperformance is identified as the learners' limited proficiency in English, the primary language of instruction, which compounds their difficulties in grasping scientific concepts.

This linguistic challenge is further corroborated by the findings of the Progress in International Reading Literacy Study (PIRLS, 2016), which indicates no significant improvement in language proficiency among Grade 4 learners. The study posits that this scenario necessitates an innovative approach to teaching science, one that is both accessible and engaging to learners from diverse linguistic and sociocultural backgrounds (Mavuru & Ramnarain, 2020; Vygotsky, 1978).

My personal teaching experience in Natural Sciences and Technology (NS-Tech) in the Intermediate Phase, particularly to Grade 4 learners, provides a practical perspective on the challenges encountered in the science classroom. The transition from teaching in isiXhosa in the Foundation Phase to English in Grade 4 is particularly challenging, as the learners are not

proficient in English at this stage. This language switch is compounded by the technical vocabulary inherent in NS-Tech, which is alien to the learners' everyday experiences. This situation is resonant with the findings of Gwekwerere (2016), who emphasises the linguistic and conceptual shift required in the learning of science. The study also draws on the insights of Kibirige and Van Rooyen (2006) and Ogunniyi and Ogawa (2008), who recognise the value of integrating IK into science teaching to create a link between learners' everyday experiences and scientific concepts, thereby fostering active engagement in the learning process.

The Curriculum Assessment and Policy Statement (CAPS) in South Africa, along with the endorsement of the United Nations Educational, Scientific and Cultural Organization (UNESCO), advocates the integration of IK into science lessons. This approach aligns with Lemke's (2001) suggestion of encouraging "learner talk" in the classroom, which is central to the sense-making process in science learning. The study is anchored in the theoretical framework of Vygotsky's (1978) sociocultural theory and Ogunniyi's (2007a) Contiguity Argumentation Theory (CAT), providing a robust analytical lens for examining the interplay between learners' social interactions and their cognitive development in science education.

1.2 Background of the Study

African learners from disadvantaged sociocultural backgrounds are confronted with numerous challenges in the realm of science education, a situation that is particularly acute in non-Western educational settings such as South Africa. As alluded to earlier, this educational dilemma is highlighted by the consistently low performance of South African learners in international benchmark tests like the TIMSS, where they are seen to struggle, notably in mathematics and science. A significant contributing factor to this underperformance is the limited proficiency in English, the primary medium of instruction in many South African schools. This language barrier impedes learners' ability to fully grasp and engage with scientific concepts, as proficiency in the language of instruction is crucial for success in science education. The Progress in International Reading Literacy Study (PIRLS, 2016) has underscored this challenge, revealing no marked improvement in language proficiency among Grade 4 learners, which further exacerbates the issue.

Drawing on my personal experiences as a Natural Sciences and Technology (NS-Tech) teacher in the Intermediate Phase, particularly to Grade 4 learners, it is evident that learners face

significant hurdles in science, more so with higher-order cognitive tasks. This situation is compounded when learners transition from Grade 3, where the medium of instruction is predominantly isiXhosa (except for the subject English), to Grade 4, where they are suddenly immersed in an English-dominated educational environment. Such a sudden transition poses a considerable challenge, not only because English is a second language for many of these learners but also because of the specific linguistic demands of NS-Tech. The technical terminology used in NS-Tech, which is not a part of the learners' everyday life contexts, further alienates them from the subject matter (Gwekwerere, 2016). Consequently, learners who have been educated in isiXhosa during the Foundation Phase find themselves at a distinct disadvantage when compared to their counterparts educated in more Western contexts, as highlighted by the findings of PIRLS (2017). These observations underscore the need for a more inclusive and accessible approach to science education in South Africa, one that recognises and accommodates the linguistic and cultural backgrounds of learners, thereby making science more engaging and comprehensible to them.

In the foundational phase of education, specifically in Grade 3, learners are engaged in Life Skills, a subject designed to lay the groundwork for their subsequent scientific learning in Grade 4. Nhase (2019) notes that within the Life Skills curriculum, a component termed "Beginning Knowledge" encapsulates elementary science concepts. However, Nhase (2019) argues that how science is embedded within Life Skills tends to obscure and blur the distinctness of science learning. During this phase, learners engage in activities like traditional music and dance primarily for enjoyment, but these activities also present untapped opportunities for introducing basic science concepts. This potential for integrating science through cultural activities is not fully used, as evidenced by Liveve's (2017) research in Namibia, which demonstrates the feasibility and effectiveness of such an approach.

Indeed, the transition from Grade 3 to Grade 4 marks a significant shift in the learning experience of learners. In Grade 4, for instance, the curriculum introduces the use of traditional musical instruments, which simultaneously serve as a medium for new science concepts. For instance, the activity of making and playing guitars is used to teach concepts like the pitch of the sound, with learners observing the production of low or high-pitched sounds. However, this instructional method often falls short as learners seem to struggle to connect these scientific concepts with their everyday experiences, a gap that is well-articulated by Aikenhead and

Jegede (1999) and Gwekwerere (2016). This disconnect leads to poor performance in science, stemming from a lack of conceptual understanding among the learners.

Addressing this educational challenge, Kibirige and Van Rooyen (2006) highlight the importance of integrating IK into science teaching. They argue that such integration has the potential to enhance learner engagement by bridging the gap between classroom learning and community experiences. This view is supported by Ogunniyi and Ogowa (2008) who contend that blending IK with scientific concepts fosters a strong connection with learners' everyday lives, as echoed by Gwekwerere (2016). This approach not only makes science more relatable and understandable for learners but also encourages active participation, discussion, and even debate during science lessons, thereby enriching the learning experience and promoting a deeper understanding of scientific principles.

Within the ambit of the South African educational framework, the Curriculum Assessment and Policy Statement (CAPS) document notably advocates the integration of IK into science education. This endorsement is rooted in the understanding that acknowledging and integrating IK could significantly help learners perceive science as an integral part of their daily knowledge and lived experiences (Gwekwerere, 2016). In tandem with this perspective, the UNESCO emphasises the need for learners to be actively supported and encouraged in their science education journey. This support is deemed essential for learners to excel in scientific disciplines.

A crucial element in this educational approach is the concept of 'learner talk' as proposed by Lemke (2001). Lemke posits that learner talk is central to the sense-making process in science education, playing a pivotal role in facilitating learners' understanding of and engagement with scientific concepts. The active engagement of learners in dialogue and discussion within the classroom is not merely a communicative exercise but forms the cornerstone of constructivist learning, where knowledge is built through interaction and reflection. This approach assumes that through learner talk, learners can significantly enhance their performance and understanding of science.

My teaching experience further informs the assumption that there is a gap in learners' comprehension of science concepts, possibly due to the lack of relatable examples from their everyday lives as reiterated by Gwekwerere (2016). To bridge this gap, I chose to employ

stories about cultural beliefs and practices, particularly focusing on traditional music and dance. This method was intended to support Grade 4 Natural Sciences and Technology (NSTech) learners from a farm school in contextualising and making sense of scientific concepts, specifically the topic of sound. By embedding the learning of sound within the familiar context of cultural music and dance, the learners were expected to develop a more concrete and relatable understanding of the scientific principles involved. This approach aligns with the broader educational goal of making science education more inclusive, culturally relevant, and accessible to learners from diverse sociocultural backgrounds (Mavuru & Ramnarain, 2020).

1.3 My Life History – Situating Myself in the Study

My name is ‘Hlengiwe’ which means “helped, rescued, redeemed”. That is exactly how my life has been. For instance, I was helped by my extended family members who took me in and sheltered me while my mother was out there hustling to better our lives. I grew up living with many cousins who became my closest sisters and brothers as we shared almost everything. My upbringing in the dusty rural areas of the Eastern Cape was not as rosy and ‘peaceful’ as one would expect, but it definitely made me a strong person that I am today.

I come from a Christian home that valued attending church services every week at the Zion Sabatha church which instilled apostolic principles in my life. Attending church was very exciting for me as I enjoyed the musical aspect of it. For example, I found the drums played exhilarating. Like those in Liveve’s (2022) study, drumheads were covered with calf skin and produced amazing beats. Sticks and hands were used to beat the drums. During that time, they used to blow a horn to summon us to gather at the church. This was important since most people neither own a wall clock nor a wristwatch. Back then we did not have any modern Western musical instruments. Through this church experience as well as from my extended family I acquired valuable knowledge that no modern classroom could ever teach me. I learned various Indigenous practices, including making an Indigenous drum from resources that were easily accessible in our village.

Whilst growing up, I was not familiarised with cultural practices or rituals because of my Christian upbringing. As a result, I experienced a cultural shock when I got married. My matrimonial family practices and embraces deep African cultural traditions and rituals. This is where I learned a lot about traditional and cultural practices, and I loved it. Back then I used to

hear people blowing whistles and singing traditional songs when there was ¹*umgidi*. I enjoyed every aspect of it from a distance as I was not allowed to associate myself with such practices which were considered to be against Christian values and beliefs.

Getting to school was a hustle as we had to walk barefoot for long distances irrespective of the weather conditions. I never complained as I enjoyed attending school and it was normal for children to walk for long distances and barefooted on their way to school. Academically, I was an average learner and I worked extremely hard to get decent grades. It is through my hard work and perseverance that I have managed to further my studies thus far.

Learning and teaching back then was based on the banking concept where we believed everything we were told and did it in exactly that way. The ability to think outside the box was restricted, in fact, close to non-existent as we could not relate what we were taught to our everyday lives. We memorised everything for us to pass. This could have been a result of educators not getting adequate training.

Currently, I am teaching Mathematics and Natural Sciences to Grades 4 to 9 classes. I started teaching Natural Sciences using the banking concept. I did not integrate Indigenous Knowledge as I did not have vast knowledge of how to do it in the classroom. In 2017, I went to further my studies at Rhodes University. This is where I learned about the benefits of integrating Indigenous Knowledge in the classroom. I did not know that integrating it would result in learners appreciating their language, cultivating their identity and using wisdom and experiences to understand what is taught in the classroom. Consequently, my learners are now actively involved in my lessons (Sedlacek & Sedova, 2017). It came out as an easier strategy to mediate content knowledge construction for learners. Since then, I never looked back as I believe that learners' prior everyday knowledge is important in my lessons (Kuhlane, 2011). Against this background, I was motivated to do a study about cultural beliefs and practices on traditional music and dance to support Grade 4 NS-Tech from a farm school talking about and making sense of the topic sound.

¹ *Umgidi* is the ceremony that is done to celebrate a boy coming back from the mountain.

1.4 My Positionality and Reflexivity in the Study

In conducting this study, my positionality was multifaceted, encompassing not only my role as a Grade 4 NS-Tech teacher with seven years of experience but also considering factors such as culture, ethnicity, language, gender, marital status and qualifications. These aspects of my identity were crucial in understanding and navigating the dynamics within the study, especially in terms of the potential impact on power relations between myself and the participants. To address this, I ensured that participation in the study was voluntary, with everyone having the freedom to withdraw at any stage.

In terms of reflexivity, which involves reflecting on and taking action throughout the research process (Holmes, 2020), my approach was proactive and adaptive. I positioned the learners as co-researchers and involved MaNkala, the science teacher, as a critical friend in the study. This approach was aligned with the recommendations of Msomi and Akhurst (2023), aiming to empower learners and encourage them to engage actively in the research process. The learners were tasked with gathering information from their homes and communities about cultural beliefs and practices related to sound and movement. This activity was intended to facilitate a connection between their school learning and home experiences, promoting what Aikenhead and Jegede (1999) and Anthony-Stevens et al. (2020) refer to as ‘border crossing’ between different knowledge systems.

Moreover, I invited IKCs who were well-versed in cultural beliefs and practices about sound and movement, positioning myself as a co-learner during their presentations. This stance was integral to my reflexivity, as it allowed me to engage with the subject matter from a learner's perspective, enhancing my understanding and appreciation of the IK being shared. For example, the decision to purchase food during the visit to uMakhulu was reflective of the cultural and ethical considerations inherent in the study. This action was not merely a logistical arrangement but was also deeply embedded in the cultural practices of hospitality and respect, which are central to conducting research within communities. This aspect of reflexivity demonstrated an awareness and responsiveness to the cultural norms and expectations of the participants, further enriching the research process and fostering a respectful and engaging environments for all involved.

1.5 Statement of the Problem

The CAPS document clearly states that IK should be integrated into science lessons, but it does not state how this should be done to help learners understand science concepts. Hence, African learners seem to struggle to understand the science taught at school because it is not connected to their daily life contexts. As a result, in the context of my study, Grade 4 learners seem to find science abstract as it is taught in a decontextualised manner which makes it difficult for them to understand (Mothwa, 2011). This could be exacerbated in part by the fact learners are taught in isiXhosa in the Foundation Phase thereby making science concepts appear new to them. This transition seems to be very challenging for learners as they struggle to comprehend what is taught in English and this might make it difficult for teachers to proceed with the lessons as they would leave many learners behind.

Because the integration of IK is seen as important in the school curriculum by scholars such as Aikenhead and Jegede (1999), learners should know that science is part of their everyday life experiences. For example, when they hear the sound of a drum, they need to connect the sound to the topic of sound taught at school (Liveve, 2017). By doing this, they associate what is taught at school with what is happening at home and hence border crossing might be enabled (Aikenhead & Jegede, 1999). My assumption, therefore, is that bringing stories into the curriculum might help learners understand that science is relevant to their everyday lives (Gwekwerere, 2016). This is in line with Iseke (2013) who posits that stories are the foundation for teaching and learning. For that reason, it was hoped that this study would help me and other teachers to use and manage classroom talk during science lessons.

1.6 Rationale and Significance of My Study

The primary aim of this formative interventionist study was to harness the rich tapestry of stories about cultural beliefs and practices, particularly traditional music and dance, as a medium to facilitate and enhance the understanding of sound among Grade 4 NS-Tech learners in a farm school setting. This approach was predicated on the belief that such narratives and practical demonstrations by ²Indigenous Knowledge Custodians (IKCs) could significantly

² Indigenous Knowledge Custodians get their name from the type of knowledge they have. They pass on the IK that their forefathers or ancestors passed down to them.

deepen learners' comprehension of sound and movement. The involvement of IKCs was pivotal as they embodied a wealth of cultural heritage, positioning them as More Knowledgeable Others (MKOs) in the Vygotskian sense (Klein, 2011; Lavalley, 2009; Vygotsky, 1978). Their role was not only to impart knowledge but also to stimulate curiosity and inquiry among learners, encouraging them to actively question and explore the concepts of sound and movement.

Moreover, the study was instrumental in fostering an appreciation of cultural diversity among learners. By integrating the narratives and practices of different cultures into the learning process, learners were able to gain a broader perspective on their own and others' cultural heritage. This aspect of the study was crucial in cultivating a sense of respect for and understanding of diverse cultural backgrounds.

In terms of pedagogical implications, the study offered valuable insights into the dynamics of integrating IK into science education. It highlighted how such integration could influence the discourse and sense-making processes of Grade 4 learners on the topic of sound and movement. A key revelation was the recognition that learners already possessed a baseline of everyday knowledge about sound, such as their familiarity with the ³*Isigodlo* – a horn used in churches to signal the commencement of services. This existing knowledge base, as noted by Kuhlana (2011), proved to be a vital link in connecting classroom learning with real-life experiences.

The storytelling approach adopted in this study served as a bridge, linking the abstract concepts of science with the tangible, everyday experiences of the learners. This connection was vital in making science relevant and meaningful to the learners' lives, as explicated by the seminal works of Aikenhead and Jegede (1999) and Gwekwerere (2016). By contextualising scientific concepts within the familiar realm of cultural practices such as drum beating, the study not only enhanced the learners' understanding but also enabled them, along with teachers, to forge a more concrete connection between science and their daily experiences.

Thus, the study underscored the significance of making science education relatable and pertinent to the lived experiences of learners. Inviting IKCs into the classroom or visiting them in their context (out-of-school context) as custodians of cultural heritage, played a pivotal role

³ *Isigodlo* – a horn used in churches to signal the commencement of services

in this study, offering both myself and a critical fellow teacher profound insight into the value of embedding such rich cultural content into our teaching practice. This approach significantly piqued the learners' interest as the stories from the IKCs provided a vibrant and relatable context for learning scientific concepts. The use of stories within the educational setting proved to be a powerful tool, resonating with the learners and fostering a deeper engagement with the subject matter. A key aspect of this approach was the presentation of these stories and concepts in isiXhosa, the mother tongue of the IKCs and the learners. This choice was particularly relevant given the challenges that learners faced in transitioning from isiXhosa in Grade 3 to English in Grade 4, a linguistic shift that often resulted in difficulties in comprehension and engagement, as previously noted. The bilingual presentation, complemented by my critical colleague's translation of the content into English, ensured that the learning experience was both linguistically inclusive and enriching. This bilingual approach not only facilitated a better understanding of scientific concepts but also catered for the learners' linguistic development. 'Translanguaging' is a pedagogical approach to teaching that involves the fluid and dynamic use of two or more languages for communication and learning purposes (Lemmi & Pérez, 2024; Mapfumo, 2024). Importantly, this methodology allowed learners to connect their pre-existing everyday knowledge with formal scientific concepts. For instance, witnessing a community member playing an *Inkinge* – a simple stringed African musical instrument – enabled learners to grasp the concept of the pitch in a tangible and culturally relevant manner. This connection between everyday experiences and scientific learning is a crucial aspect of effective science education.

The outcomes of this study may also have significant implications for curriculum development. It highlights the necessity for curriculum developers to acknowledge and integrate IK into the learning process, thereby bridging the gap between the learners' existing knowledge base and the formal science curriculum. Indeed, this study serves as a practical example of how IK can be seamlessly integrated into the teaching of science, addressing a gap that is currently not adequately covered by CAPS.

1.7 Research Goal and Research Questions

The main goal of my study was to use stories about cultural beliefs and practices on traditional music and dance to support Grade 4 NS-Tech learners from a farm school in talking about and making sense of the topic of sound.

Research questions

To achieve the above goal, the following research questions will be addressed:

1. What stories about cultural beliefs and practices on traditional music and dance do Grade 4 Natural Sciences and Technology learners from a farm school know from their homes and community?
2. How do the presentations by the Indigenous Knowledge Custodians on stories about the cultural beliefs and practices of traditional music and dance and consolidation thereof enable or constrain Grade 4 Natural Sciences and Technology learners from a farm school from talking about and making sense of the topic of sound?
3. (a)What enables Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound after the intervention?

(b)What constrains Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound after the intervention?

1.8 Theoretical and Analytical Frameworks

The theoretical and analytical frameworks of this study are anchored in Vygotsky's (1978) sociocultural theory and the Contiguity Argumentative Theory (CAT) developed by Ogunniyi (2007a). These frameworks provide a robust basis for analysing the intricate dynamics of learning in contexts where distinct thought processes, such as science and IK intersect.

Vygotsky's sociocultural theory posits that learning is a deeply social process, fundamentally influenced by interactions within one's sociocultural environment. This theory emphasises the role of social interactions in the development of cognitive abilities, suggesting that knowledge is constructed through these interactions. The theory provides a foundation for understanding how learners acquire new experiences and assimilate knowledge through engagement with their physical and sociocultural surroundings. Complementing this, the CAT, as conceptualised by Ogunniyi (2007a), offers a nuanced analytical framework specifically suited to contexts where science and IK converge. Govender (2014) underscores the significance of argumentation in enhancing comprehension, which is a key aspect of CAT. CAT delineates five categories that describe how ideas and conceptions move and transform among learners:

dominant, suppressed, assimilated, emergent and equipollent. Each category represents a different cognitive state or process that learners undergo when encountering new information or ideas.

For instance, in the context of this study, learners may initially hold dominant conceptions about sound that are rooted in their everyday experiences, as illustrated by Liveve (2017). These conceptions are supported by observable facts or compelling cultural explanations. Conversely, emergent conceptions arise when learners lack previous knowledge of a subject, necessitating the formation of new cognitive frameworks. This scenario is common in educational settings where learners are introduced to novel concepts. In situations where two opposing ideas exert equal influence on the learners' thought process, they enter an equipollent cognitive state, allowing for the coexistence of these ideas without conflict.

Integrating CAT with Vygotsky's sociocultural theory creates a comprehensive framework for understanding the cognitive and social dimensions of learning. This integration is particularly relevant to this study, as CAT was employed to analyse the evolving thoughts and dialogues that emerged during social interactions in the classroom, including group discussions, presentations by IKCs and learners' reflections in their journals. This blended approach aligns with Vygotsky's recommendation (1978) of analysing learning as a process influenced by social interactions and cultural contexts. Consequently, these frameworks are instrumental in providing a deeper understanding of how learners engage with and make sense of science concepts, particularly in a culturally diverse educational environment where IK is integrated into the science curriculum.

1.9 Data-Gathering Methods

Four data-gathering techniques were used to gather data for this study. These techniques were:

- Focus group interviews;
- Group activity;
- Participatory observation; and
- Journal reflections.

1.10 Definition of Key Concepts

Indigenous Knowledge: As articulated by Kibirige and Van Rooyen (2006), IK represents a rich legacy of knowledge and skills that are unique to a particular indigenous culture. This form of knowledge encompasses wisdom that has been meticulously developed and passed down through generations. It is intrinsic to the cultural and social fabric of indigenous communities and is often integral to their way of life, encompassing a wide array of practices, beliefs and understandings.

Sociocultural theory: Originating from the seminal work of Vygotsky (1978), sociocultural theory is a framework in social learning that emphasises the role of social interactions in the process of learning. It posits that learning occurs through interactions with others within a cultural context. This theory underscores how cultural beliefs, values and attitudes shape and influence these interactions, playing a pivotal role in the cognitive development of individuals.

Sound: Sound is defined by Kadis (2015) as a phenomenon that occurs when our ears detect vibrations in the air or through solid objects. It is a fundamental concept in the study of physics and underpins many aspects of our daily experiences with the environment around us. Understanding sound involves exploring its production, transmission, and reception, all of which are central to the scientific exploration of this natural phenomenon.

Natural Sciences and Technology: This is a school subject in the Intermediate Phase, which amalgamates two distinct, but interrelated disciplines as outlined by the South Africa Department of Education (DoE, 2011).

- **Natural Sciences:** This branch of science is concerned with the description, prediction and understanding of natural phenomena. It is grounded in empirical evidence derived from observation and experimentation, covering a wide range of scientific inquiries into the natural world.
- **Technology:** Defined as the application of knowledge, skills, values and resources to develop practical solutions to problems, technology takes into account social and environmental factors. It involves a creative and innovative process of designing and creating products, systems or environments to meet human needs and improve the quality of life.

These definitions provide a foundational understanding of the key concepts that inform the theoretical and practical aspects of the study, thereby facilitating a comprehensive exploration of how IK can be integrated into the teaching of NS-Tech, with a specific focus on the topic of sound.

1.11 Thesis Outline

The thesis is structured to explore the integration of IK into the teaching of NS-Tech with a specific focus on sound. The outline of the thesis is as follows:

Chapter One: Situating the Study: This section sets the stage for the research by outlining the background, rationale, and objectives of the study. It contextualises the challenges faced by Grade 4 learners in understanding science concepts, particularly in non-Western settings like South Africa, and highlights the potential role of IK in enhancing science education.

Chapter Two: Literature Review: An in-depth review of existing literature on the integration of IK in science education is provided.

Chapter Three: Theoretical Frameworks: This chapter elaborates on the theoretical underpinnings of the study, focusing primarily on Vygotsky's sociocultural theory and the CAT. It discusses how these theories provide a framework for understanding the learning processes in a culturally diverse educational context.

Chapter Four: Research Methodology: This section details the research design, sample selection, data collection methods and analysis techniques. It explains the rationale behind choosing a qualitative case study approach and describes the participatory methods used for data gathering, including group activities, interviews, observations and journal reflections.

Chapter Five: Group Presentations and Presentations by the Indigenous Knowledge Custodians: This chapter presents, analyses and discusses findings from the data generated using learners' group activities and presentations by the IKCs.

Chapter Six: Lesson Observations, Focus Group Interviews and Journal Reflections: This chapter presents, analyses and discusses findings from the data generated using lesson observation, focus group interviews (sharing circles) and learners' journal reflections.

Chapter Seven: Summary of Findings, Recommendations and Conclusion: The thesis concludes with a summary of the findings, highlighting the key contributions of the study to the field of science education. It also provides recommendations for educators, curriculum developers, and policymakers on incorporating IK into science curricula.

1.12 Chapter Summary

The chapter begins by providing background information about the study. The literature from various researchers, along with the South African curriculum known as CAPS, were discussed, highlighting the need for and significance of doing this study. The statement of the problem and rationale for my study were discussed, along with relevant literature. Finally, the chapter finished with the study's research goals and research questions. In the following chapter, I discuss literature relevant to the topic.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The introduction to the literature review chapter sets the stage for an in-depth examination of various studies and scholarly works relevant to this research. As Nayak and Singh (2015) aptly describe, a literature review serves as an evaluative report, encompassing an array of both written and spoken works that collectively contribute to the understanding of the selected research area. In this chapter, the focus was on dissecting and understanding the interplay between sound and movement, a central theme of this study.

The discussion begins with an exploration of the existing literature on learners' prior knowledge, an aspect crucial to understanding how learners come to terms with new scientific concepts. This part of the literature review examines how learners' pre-existing knowledge, experiences, and cultural backgrounds influence their learning process, particularly in the context of sound and movement. Following this, the role of IK in the learning process is discussed. Here, the literature review delves into how IK, with its rich cultural and traditional heritage, can be integrated into the teaching of science, thereby making learning more relatable and effective for learners from diverse cultural backgrounds.

The review also covers the significance of stories in education, particularly their role in teaching complex scientific concepts. This includes an examination of how narrative techniques and storytelling can aid in the teaching of abstract concepts like sound and movement, making them more accessible and relevant to learners. In addition, the chapter looks into the influence of hands-on practical activities and visualisations in science classrooms. This section evaluates the effectiveness of experiential learning methods and how they contribute to a deeper understanding of scientific concepts among learners.

The role of language in learning, especially in science education, is another critical aspect covered in this chapter. This includes a discussion of how language barriers can affect learning and the importance of using language as a tool for better comprehension and engagement in

the classroom. Lastly, the chapter delves into conceptual understanding and sense making in science education. This part evaluates how learners process and internalise scientific concepts, with a specific focus on how they make sense of sound and movement in the context of this study. The chapter concludes with a summary that encapsulates the key findings from the literature review, providing a coherent overview of the existing knowledge in the field and setting the groundwork for the research. This summary serves as a bridge connecting the reviewed literature to the research questions and objectives outlined in the study.

2.2 Sound and Movement

In the realm of science education, particularly in the context of teaching Natural Sciences and Technology (NS-Tech) to Grade 4 learners, the use of instruments to demonstrate sound production is a common and essential practice. These instruments generate sound waves at specific frequencies, offering a tangible way for learners to understand the principles of sound. Liveve (2017) emphasise that dance, much like these instruments, serves not only as an art form but also as a medium to express social relationships and shared cultural ideals. By integrating IK of traditional instruments and dance into NS-Tech teaching, educators can provide a more holistic and culturally relevant understanding of sound and its properties.

In this regard, Idamoyibo (2016) highlights the significant role of African traditional music in conveying and transmitting cultural knowledge through sound. Sound, fundamentally, is a form of energy created by vibrations. These vibrations, or energy waves, travel through various media – air, liquid, or solid - to reach our ears. As Mayana (2020) describes, these waves originate from a periodic disturbance and consist of a sequence of repeated patterns, as detailed by Kadis (2015). The intensity of these vibrations directly correlates with the loudness of the sound: stronger vibrations result in louder sounds, and as the distance from the sound source increases, the intensity of the sound decreases, a phenomenon known as the Doppler Effect.

An important aspect of sound is its pitch, determined by the speed of the vibrations producing it. The pitch of a sound can be high or low, depending on the frequency of these vibrations. Different materials and objects, vibrating at different speeds, produce sounds of varying pitches. For example, a high-pitched sound is produced by an object vibrating quickly, whereas a slower vibration results in a low-pitched sound. This understanding of pitch and its relation to the speed of vibrations is crucial for learners as they explore the science of sound.

In the exploration of sound and its production, particularly through traditional musical instruments, the study draws on the insights of Liveve (2017, 2022), highlighting the fundamental role of movement in generating sound. Traditional musical instruments, such as drums, exemplify this principle. These instruments produce sounds through the mechanism of standing waves, which are formed due to the constructive interference of waves travelling in opposite directions, typically along strings or within tubes.

Liveve (2022) provides a detailed examination of how a drum produces sound. The drum, characterised by its thin membrane or skin stretched tightly over an opening of a hollow object, vibrates when struck, resulting in the production of sound. This vibration, a fundamental aspect of sound production in various musical instruments, is central to the understanding of sound waves. The presence of drums in community dances, as explained by Liveve (2022), signifies their importance as a primary source of sound waves in cultural contexts. This aspect of traditional music and dance is integral to the study, as it aligns with the intention to incorporate these cultural elements into science education. The intention is to leverage learners' familiarity with these cultural practices to facilitate a better understanding of scientific concepts like waves and echo, thereby positively influencing their attitudes towards the learning of science and enhancing their sense making of sound.

This approach is supported by the work of Kuhlane (2011), who suggests that leveraging learners' prior everyday knowledge, particularly experiences related to music and dance from their homes and communities, can be highly beneficial in the context of science education. Dunn (2001) also found that early literacy experiences, deeply embedded in the cultural and oral traditions of families and communities, significantly influence children's learning opportunities in formal educational settings. These findings underscore the importance of recognising and integrating oral traditions and cultural practices, including songs, dances and symbolic representations, into the science classroom. Such integration not only acknowledges the rich cultural heritage of learners but also uses it as a valuable resource in teaching and learning processes. The arguments listed above emphasise that science teachers need to take into consideration their learners' prior everyday knowledge in their science classrooms.

2.3 Learners' Prior Everyday Knowledge

Kuhlane (2011) illuminates the concept of prior everyday knowledge as a crucial element in the learning process, suggesting that it fundamentally shifts the perception of learning to one of conceptual transformation. This perspective posits that learning is virtually impossible without a foundation of prior knowledge, emphasising that what a learner already knows is paramount in shaping their educational journey. This prior knowledge, encompassing both its breadth and depth, significantly impacts knowledge acquisition and the application of higher order cognitive skills. The construction of a learning environment that actively leverages this pre-existing knowledge is therefore essential for fostering an integrated framework for learning.

Dolmans (2016) further elaborates on this by pointing out that surface learning occurs when there is a disconnect between new knowledge and existing knowledge frameworks. In this context, learners come to the classroom with a unique set of experiences, understandings, skills and values. For instance, Grade 4 learners in this study are likely to have some foundational understanding of sound based on their everyday experiences at home. This pre-existing knowledge influences how they perceive and assimilate new information presented in the classroom, enabling them to construct new knowledge based on what they already know. Placing learners' prior knowledge at the forefront of the educational process is thus a key strategy in constructive learning, where the role of the educator is to identify and build upon this knowledge.

However, as Roschelle (1995) cautions, prior knowledge does not always align with scientific understanding and can sometimes provide a misleading basis for understanding new concepts. This sentiment is echoed by Taylor (1999), who warns that prior knowledge can include misconceptions. Hodson (2009) also raises concerns about the indiscriminate integration of all forms of knowledge into the science curriculum. Despite these cautions, it is recognised that prior knowledge can take the form of IK, which offers a rich and culturally relevant foundation for learning and understanding scientific concepts. The integration of IK into science education acknowledges and values the cultural and experiential background of learners, enhancing their engagement and comprehension of scientific concepts.

2.4 What is Indigenous Knowledge?

Indigenous Knowledge (IK) is a concept that has been defined and understood in various ways, reflecting its depth and diversity across different cultures and communities. Kibirige and Van Rooyen (2006) describe IK as a legacy of knowledge and skills unique to a specific indigenous culture, encompassing wisdom developed and transmitted across generations. This definition is echoed by Mapara (2009) and Semali and Kincheloe (1999), who similarly define IK as a legacy of information and abilities specific to indigenous cultures, characterised by wisdom nurtured and passed down through generations.

The UNESCO (1999) broadens this definition by characterising IK as a comprehensive body of knowledge and abilities that arise outside the formal education system, playing a critical role in enabling communities to flourish. This body of knowledge is intrinsic to Indigenous peoples' unique ways of knowing, being, valuing and living in the world, as articulated by Brayboy and Maughan (2009). Mkabela (2015) further contributes to this definition by highlighting the localised nature of IK, describing it as knowledge that is inherent to and developed within a specific geographical area and cultural framework.

Seehawer (2018) defines IK as knowledge systems developed by local or indigenous peoples over generations, shaped by their continuous occupation of or attachment to a particular place. These systems embody traditions that are handed down from generation to generation, forming the bedrock of human understanding across cultures. Mavuru and Ramnarain (2017) argue that African communities possess a wealth of science and technology knowledge transmitted orally and through cultural customs across generations. The integration of IK into educational settings, particularly in classrooms, is seen as a means of decolonising and Africanising science education. This integration, as noted by Mukwambo et al. (2014), Seehawer (2018) and Seehawer and Breidlid (2021), is not just about including indigenous content in the curriculum but also about linking indigenous-specific cultural practices, learning processes and values with formal education. It represents a move towards acknowledging and valuing the rich and diverse ways of knowing that exist within indigenous communities, thereby enriching the educational experience for all learners.

In this study, the primary medium for conveying cultural heritage was through storytelling, a tradition deeply embedded in various cultures. To integrate IK into the learning process, I

invited community members, referred to as IKCs, to share stories about traditional music and dance with my learners. These custodians were also asked to demonstrate traditional musical instruments, facilitating a hands-on learning experience. This intervention was designed to help learners deepen their understanding of sound and related concepts, such as pitch, and to comprehend how these musical instruments are played and produce sound. Instruments like the marimba, drum and guitar were used, in recognition of their potential educational benefits.

The CAPS (2011), in line with Klein (2011), recognises IK as a vast body of knowledge and skills developed outside the formal education system, crucial for community survival. Mosimege and Onwu (2004) describe IK as encompassing the technologies and practices indigenous and local people have historically used to adapt to their environments. This view is shared by Mosimege and Onwu et al. (2011), who note that IK is dynamic and evolves through interaction with other information systems. Nyika (2017) perceives IK as information unique to a particular society. Similarly, Kibirige and Van Rooyen (2006) define IK as a heritage of knowledge and skills unique to a specific indigenous culture, encompassing wisdom developed and passed down through generations.

However, Horsthemke and Schafer (2007) present a critical perspective, arguing that the concept of knowledge possession is often based on racial and indigenous distinctions. They caution against the uncritical acceptance and integration of IK, noting that it can sometimes be perceived by indigenous learners as irrelevant, outdated or even alienating. They warn against the unexamined adoption of anything labelled as indigenous.

Considering these criticisms, it is essential to approach the integration of IK with a balanced perspective. While recognising its value and significance, it is also important to address and correct any misconceptions associated with IK. This approach ensures that the integration of IK into the curriculum is done thoughtfully and respectfully, honouring the richness of Indigenous cultures while also maintaining educational rigour and relevance. Noteworthy also is that some proponents of IK integration such as Ogunniyi (2007a) caution against the dangers of romanticising IK. Unlike Horsthemke and Schafer (2007) who seem to outrightly reject the integration of IK, these scholars propose that any misconceptions that might come with IK need to be corrected.

2.5 Indigenous Knowledge in South African Science

The incorporation of Indigenous Knowledge Systems (IKS) into South African science education is a concept that has significant implications across all learning areas and educational levels. The CAPS documents portray IK as dynamic and expansive, transcending the limitations of being associated solely with people of African descent. The CAPS document encourages teachers to explore and integrate IK from diverse cultural groups, a task that, while challenging in multicultural environments, reflects an inclusive orientation in curriculum design. This approach signifies a shift in the perspective of scientific knowledge creation, advocating a multicultural approach in science education.

Specifically, the CAPS document highlights that the integration of IK into science education should relate directly to the subject content and is intricately linked to enhancing cognitive abilities. However, IK encompasses more than just cognitive information; it includes performative knowledge, talents, practical skills and worldviews. This broad spectrum of knowledge challenges the conventional, often Western-centric, cognitive and representational view of knowledge in science education. Le Grange (2008) and Turnbull (1997) have criticised this limited perspective, emphasising the need to recognise and value the diverse knowledge systems that exist beyond the Western paradigm.

In this study, my objective was to introduce learners to IK by inviting community members into the classroom to share their stories and experiences related to sound and movement. This approach aimed to broaden the scope of science education, moving beyond the traditional confines of textbook knowledge to encompass the rich, experiential learning that IK offers. By integrating IK into the science curriculum, learners can gain a more comprehensive and relatable understanding of the scientific concepts taught in school. This integration of IK and science is not just about adding cultural content to the curriculum; it is about reconceptualising the way science is taught and learned. It is about acknowledging and valuing the unique contributions of various cultures to scientific understanding, thereby enriching the educational experience for all learners. Through this approach, learners are not limited to a singular view of science. Instead, they are exposed to a more holistic and inclusive perspective that encompasses the diverse ways of knowing and understanding the world around them.

2.6 The Need for the Integration of IK in Science Lessons

The integration of IK into science lessons is not just a beneficial addition but a necessity, given the socially constructed nature of knowledge in science. As Khupe (2014) argues, science is deeply rooted in the sociocultural environment making it necessary for cultural aspects of knowledge to be considered in science education. In South Africa, the importance of IKS is recognised at a national level, with the Department of Science and Technology leading the charge in advocating for its documentation, incorporation into education and the sharing of benefits with local communities (Mosimege, 2005). This national priority aligns with the constitutional mandate from the Department of Education to value IKS across all subject areas (DOE, 2003).

The commitment to integrating IKS into the educational curriculum is further evidenced by the prioritisation of IKS research by the National Research Foundation and the establishment of initiatives like the Sciences-Indigenous Knowledge Systems. Additionally, the creation of journals such as ⁴*Indilinga: African Journal for IKS* contributes significantly to the body of research in this area. Research both within South Africa and internationally supports the integration of IK into science lessons. Studies have shown that this integration enhances critical thinking skills (Msimanga & Lelliott, 2014; Mutanho, 2016; Nyamakuti, 2021), increases learner participation (Diwu & Ogunniyi, 2012; Mateus & Ngcoza, 2019; Sedlacek & Sedova, 2017), boosts learner motivation and self-esteem (McKinley, 2005), and makes science more comprehensible to learners (Asheela et al., 2021; Kuhlana, 2011; Shinana et al., 2021).

These findings highlight the multifaceted benefits of integrating IK into science education, suggesting that it not only enriches the learning experience but also aligns with the broader goals of inclusive and culturally responsive education. The inclusion of IK in science lessons, therefore, is not merely an optional enrichment but a crucial component in creating a more holistic, engaging and relevant science education that resonates with the diverse backgrounds and experiences of learners.

⁴ *Indilinga: African Journal for Indigenous Knowledge Systems* contributes significantly to the body of research in this area.

2.7 Storytelling in Science Learning

Storytelling is a practice in Indigenous cultures that supports communities and validates Indigenous peoples' experiences and epistemologies (Iseke, 2013; Tzou et al., 2019). According to Iseke (2013), storytelling allows indigenous peoples to convey their experiences in indigenous languages while also nurturing relationships and the exchange of IK and customs. My grandparents and elders in my community also used storytelling to pass down essential and relevant knowledge to us; for example, they would narrate folk stories to us to pass on principles, values and beliefs. What was amazing was how my grandparents encouraged us to take charge of listening to, interpreting, and reflecting on stories. We would sit in a circle around the fire, which promoted debate and allowed for full participation by everyone (Sedlacek & Sedova, 2017; Vygotsky, 1978). According to Iseke (2013), storytelling is a pedagogical instrument for learning about life. Tzou et al. (2019) agree, emphasising the importance of narrative in presenting and making visible other ways of knowing and being. For this study, an IKC used storytelling to impart her local or IK on sound and movement aspects, which we then had to include in our lesson to make science relevant and accessible to our learners.

Storytelling in the classroom is one way of addressing literacy development by enhancing spoken language, reading comprehension and writing (Iseke, 2013). Stories were once used to transmit knowledge of crucial importance from generation to generation (Bruner, 1990). Stories are told to entertain, to influence the listener's aesthetic, ethical or emotional reactions (Chilisa, 2012). In essence, storytelling acts as a trigger to get listeners to focus on the speaker and the message (Liveve, 2022). According to scholars like Smith (2012) and Seehawer (2018b), storytelling is a means of information transmission in many African societies and reflects oral tradition. Including community members and their stories should build an engaging learning environment. Making new learnings meaningful to learners can be accomplished by structuring the instruction around stories about sound and movement that are based on their existing knowledge. Science will be simpler for learners to comprehend. Because the learners are active in giving the stories significance, storytelling can be pedagogically successful, claim Martin and Brouwer (1991). The imagination and the feeling of anticipation are both important but undervalued intellectual abilities in science education, yet they can be developed by telling stories to learners.

2.8 Challenges

While the integration of IK with science in the classroom presents numerous benefits, it is not without its challenges. One of the primary hurdles is the reluctance or inability of teachers to adopt IK for their teaching. This reluctance can often be attributed to the pressures associated with curricular revisions. These revisions frequently demand rapid changes and adaptations from teachers, who may find themselves overwhelmed by the pace and scope of these changes, often compounded by a lack of clear guidance or direction on how to effectively integrate IK into their teaching practices (Mushayikwa & Ogunniyi, 2011; Naidoo, 2007).

Another significant challenge lies in the preparedness of educational institutions at various levels, including schools, districts, and provincial authorities, to embrace IKS. A notable impediment here is the absence of well-defined policies or guidelines for integrating IKS into the teaching and learning process. This lack of a structured framework not only hinders the adoption of IKS for educational settings but also contributes to inconsistencies in how IK is approached and taught across different schools and regions. The absence of such regulatory guidelines can lead to uncertainty and inconsistency in how IKS is incorporated into the curriculum, thereby impacting the effectiveness and uniformity of its integration across educational institutions (Mushayikwa & Ogunniyi, 2011; Naidoo, 2007).

These challenges highlight the need for a more structured and supportive approach to the integration of IK into science education. This would involve not only revising curricula to include IK but also providing educators with the necessary training, resources and guidelines to effectively implement these changes. The development of clear policies and frameworks at the district and provincial levels can also help ensure a more systematic and consistent integration of IKS across various educational settings. Addressing these challenges is crucial for realising the full potential of incorporating IK into science education and for providing learners with a more comprehensive and culturally relevant educational experience.

2.9 Advantages of Integrating Indigenous Knowledge into Science

Indigenous knowledge (IK) has the potential to boost learners' engagement (Sedlacek & Sedova, 2017), and facilitate cross-cultural communication from home or community to science classrooms (Aikenhead & Jegede, 1999). It can also provide a forum for discussing the interactions between Western and indigenous worldviews (Mushanyika & Ogunniyi, 2011).

Kibirige and Van Rooyen (2006) propose that science instruction becomes more successful when IK is viewed as pre-existing knowledge and as a foundation for learning. These authors go on to say that IK fosters effective communication. Thus, it serves as a guiding tool to help learners bridge the knowledge gaps that exist between what they already know and what they need to acquire (Nikodemus, 2017).

Furthermore, according to Shizha (2007), learners are more likely to participate when they study material that they can relate to. To further support this, Le Grange (2007) and Mukwambo et al. (2014) suggest that IK integration might significantly advance the cultural re-evaluation of IK. In a similar vein, Seehawer (2021) asserts that the integration of IK ought to be seen as a calculated approach to resolving the challenges associated with modern education. As a result, by integrating cultural knowledge into science classes, the curriculum can be changed to facilitate the study of sound through stories and dance through cultural music.

For example, community members in my study tell stories about traditional dance and music. To comprehend sound and movement (thinking of the present), learners will connect the concept to their past knowledge (connecting the past) when community members offer their cultural expertise on these topics. This can be attributed to the claim made by Chikamori et al. (2019) that learners intentionally weigh what they have learned from their initial learning experience concerning what they already know from the past. This explains the importance of the role of community members in the classroom.

2.10 Role of Community Members in Science Classrooms

In understanding the role of community members in the science classroom, it is essential to recognise the breadth and depth of IK that these individuals bring. This knowledge manifests in various forms, including language, beliefs, values, customs, institutions, technologies, education, artefacts, games, food, rituals and ceremonies, as outlined by Gadzirayi et al. (2006). Elders in communities, in particular, are often the custodians of this rich heritage. They are not only educators of children, teenagers, and adults but also serve as community storytellers and historians, using their narratives as educational tools to pass down cultural traditions and values, as noted by Iseke and Brennus (2011). In the context of this study, these elders are considered MKOs, a term derived from Vygotsky's (1978) theory, highlighting their role in the learning process.

However, a challenge identified by Nakata and Langton (2009) is the diminishing number of elders who possess extensive oral knowledge. This decline underscores the importance of documenting this wisdom to preserve it for future generations. Addressing this need, the current study engages with expert community members knowledgeable in IK and local practices. This collaboration is aimed at not only preserving this knowledge but also making it accessible within local schools. In this way, educators can integrate this valuable resource into their teaching, particularly in subjects like Natural Sciences. This integration can take the form of hands-on practical activities, allowing learners to visualise and engage with the content more effectively.

Moreover, as indicated by Mateus and Ngcoza (2019) and Klein (2011), the involvement of community members in the educational process brings a wealth of real-life experience and cultural relevance to the classroom. It enriches the learning environment by providing learners with practical examples and a deeper understanding of the subject matter rooted in their cultural context. This approach not only enhances the educational experience but also fosters a greater appreciation of local knowledge and practices among learners.

2.11 Hands-on Practical Activities and Visualisation

Any teaching strategy that involves activity and firsthand involvement with natural phenomena or any educational experience that actively involves learners in manipulating items to obtain knowledge or comprehension is referred to as ‘hands-on science’ (Asheela et al., 2021). Practical activities are activities in which learners work individually or in groups, handling and observing the objects or materials they are studying (Millar, 2010). Hands-on practical activities have an important role to play in science classrooms (Asheela et al., 2021). A hands-on approach is a way of teaching where learners are encouraged to learn via experience like exploring and observing. Learning activities that involve learners handling and examining the items or materials they are studying are known as practical activities (Millar, 2010). Banu (2011) emphasises that numerous studies have demonstrated the benefits of practical work in science teaching and learning by making the subject relatively simpler to understand and by enhancing learners’ subject matter expertise. For instance, according to this study, learners’ learning will be improved if they participate in real-life activities and watch their elders perform with traditional instruments.

In this regard, I think that adopting hands-on teaching techniques as opposed to a conventional approach helps learners grasp science concepts more effectively as learners will be able to interact with the IKCs and observe what is provided to them. This might encourage learners to converse freely and inquire about the musical instrument. Both IKCs and learners will speak in their native tongues, highlighting the significance of language in Grade 4 and learners will be able to see what is presented by the IKCs and be able to engage with them. This might help them to talk and ask questions about the musical instrument more freely.

While hands-on practical activities have a lot of potential, some scholars doubt how well they work as teaching and learning tools in science classrooms. For example, Hodson (1990) says that practical work is misinterpreted, confusing, and fails to give learners the results they want. Asheela et al. (2021) issued a warning in response, stating that learners should record scientific concepts that they can use to create mind maps and further develop concept maps, in addition to using their hands to manipulate the materials in hands-on practical activities. According to Asheela (2017), inadequate use of practical hands-on activities may stem from a lack of materials and laboratory equipment. Asheela et al. (2021) suggest that teachers use readily available resources when conducting practical hands-on activities as a solution to this issue. I now discuss learner talk and the role of language in the learning of science below as I believe that these can be stimulated by hands-on practical activities and visualisation.

2.12 The Role of Language in Learning Science

Language plays a pivotal role in the transmission of IK, as emphasised by Battiste (2005). It acts as a conduit for conveying people's traditions, customs, morality, and beliefs, a perspective supported by Masondo (2013). Vygotsky (1978) further underscores the significance of language, considering it the most crucial tool in the creation of knowledge. This is particularly relevant in science education, where teaching in the learners' home language can empower them, enabling clear and fluent communication of ideas, as Nhase (2019) suggests.

The importance of language extends to hands-on activities in the classroom, where both instruction by teachers and communication by learners are essential for effective learning (Asheela et al., 2021). Language serves not just as a means of communication but as a cultural tool that shapes learning and thinking processes (Mika, 2018). Mavuru and Ramnarain (2019) describe a cultural clash often observed in science classrooms, particularly in rural and

township schools, where the home language and culture of learners intersect with the culture of science, predominantly influenced by Western perspectives, a position supported by Cobern (1998).

Despite curricular mandates, research reveals that teachers often face challenges in integrating IK into their lessons (Mutanho, 2021). Storytelling, a traditional method used by indigenous people to pass on knowledge (Iseke, 2013; Tzou et al., 2019), emerges as a powerful tool in this context. Msimanga and Lelliott (2014) argue for the importance of allowing learners, especially those who may lack proficiency in English, to engage with complex subjects in their native languages. This approach facilitates a deeper understanding and construction of knowledge, enabling learners to make sense of science in a language they are comfortable with. Mavuru and Ramnarain (2019) further reinforce this idea, stating that it is through language that learners can effectively construct knowledge and comprehend science, highlighting the fundamental role language plays in the learning process.

2.13 Learner Talk and Sense Making

In the context of science education, a key goal for teachers is to enhance learners' conceptual understanding and engage them in the process of sense making. As outlined by Hodson (2001), this involves not only grasping scientific concepts but also developing the skills to manipulate variables and solve problems. Sense making, as described by Wieck et al. (2005), involves interpreting and transforming circumstances into a form that can be explicitly articulated, thereby facilitating meaningful action. This process is integral to the educational experience, as it allows learners to connect new information to their existing knowledge and experiences.

Nikodemus (2017) highlights the crucial role of language, discussion and communication in sense making. This process occurs when learners can contextualise and relate scientific concepts to their societal and environmental experiences. In this study, engaging with IKCs in the learners' native language, isiXhosa significantly contributed to this process. Learners were able to participate during practical demonstrations, leading to a deeper and more meaningful understanding of the concepts being taught.

Observations during the study revealed that learners were able to make sense of the information presented by the IKCs. This was particularly evident in how they conceptualised sound and movement during the presentations. The use of their mother tongue facilitated a more profound

engagement with the content, allowing them to assimilate the new information in a manner that resonated with their prior knowledge and cultural background. This approach underscores the importance of incorporating cultural relevance into science education, as it not only aids in sense making but also fosters a more inclusive and engaging learning environment.

2.14 Chapter Summary

Chapter Two explored several key aspects that are crucial in shaping the learning process of sound exploration through cultural music and dance stories by Grade 4 farm school learners. Firstly, the significance of sound and movement was emphasised in understanding the principles of sound. For example, drums and other musical instruments generate sound waves at specific frequencies. This provided learners with a concrete way to make sense of sound. The approach of grounding the activities in real phenomena is aligned with the idea of experiential learning, where learners actively engage with real-world phenomena while pursuing a conceptual understanding of scientific concepts. Additionally, the chapter underscored the salient point that learners' everyday knowledge of the world plays a critical role in the learning process. This perspective accentuates the importance of acknowledging and integrating learners' existing knowledge into the learning process, thereby fostering a more meaningful and effective educational experience. Nuntsu (2020) asserts that learners draw on critical aspects of their prior and evolving everyday knowledge in learning to reorganise and restructure it, a crucial aspect of conceptual transformation.

The chapter also discussed the concept of IK and the benefits it provides when it is integrated into science lessons, including boosting learners' engagement and facilitating cross-cultural communication from home or community to science classrooms. As such, the CAPS document highlights that the integration of IK into science lessons should relate directly to the subject content to enhance learners' cognitive abilities. The chapter concluded with a discussion of how community members can greatly contribute to the learning experience of learners and why teaching approaches that integrate interactive, hands-on activities and visual aids are crucial. The significance of promoting learning techniques involving personal involvement and firsthand experience with natural occurrences aligns with experiential learning principles as well as constructivist educational theories.

CHAPTER THREE: THEORETICAL FRAMEWORK

3.1 Introduction

Theoretical frameworks play a crucial role in research, as they provide a lens through which data are analysed and interpreted. Frameworks guide and inform research endeavours, while also providing key variables and theories that facilitate the definition of research objectives, research questions, as well as the methodology to be used. They serve as a map that shapes the inquiry and elucidates the relationship between different variables based on a predefined theoretical perspective.

This research employs Vygotsky's (1978) sociocultural theory and Ogunniyi's (2007a) Contiguity Argumentative Theory (CAT), two complementary theoretical models, to explore how cultural music and dance stories assist Grade 4 farm school learners in learning about sound. Vygotsky's (1978) sociocultural theory provides valuable insights into how cultural and social interactions help to shape cognitive development. It offers a unique framework for understanding cultural elements and social interactions that affect the learning process. Ogunniyi's (2007a) CAT introduces the role of contiguity and argumentation in the learning process, two concepts that are crucial in shaping this research. Drawing on these frameworks, this study aims to provide a holistic understanding of how social interactions and cultural elements can influence Grade 4 farm school learners' acquisition of auditory knowledge.

3.2 Vygotsky's Sociocultural Theory

The basic objectives of education, in the words of Vygotsky (1978), are to produce and grow, and this is done through social learning and the internalisation of cultural and social relationships. Without society serving as the custodian of cultural legacies, it is challenging for people to grow mentally, according to Vygotsky (1978). The Vygotskian sociocultural theory (Scott, 2004) integrates both group and individual perspectives, finding common ground with the useful notion that a learner cannot be a passive recipient of knowledge and instruction

(Govender, 2014). Additionally, with the use of cultural tools like language, learners can adapt their talents to the culture in which they live. In the context of my study, learners are accustomed to music and action when they come to school. They should apply what they already know to make sense of the new knowledge because they are not familiar with the scientific principles that are taught in school. In this way, sociocultural pedagogy promotes successful classroom interaction, which in turn promotes equity in instruction while also fostering variation. According to Vygotsky, this method stresses relying on the learners' diverse sociocultural backgrounds (Mavuru & Ramnarain, 2020). From the sociocultural theory, I employed the following concepts: the mediation of learning, culture and language, social interactions and the zone of proximal development themes (ZPD). I will now discuss each of these below.

3.2.1 Mediation of learning

The concept of mediation is crucial to Vygotsky's sociocultural point of view. It implies that controlling developmental learning and teaching contexts is essential (John-Steiner & Mahn, 2008). As learners transition to new knowledge types from those already known to them, mediation of learning aims to transform learners' capacities from lower to higher cognitive functions (Kozulin, 2012).

In the sociocultural perspective advocated by Vygotsky, the idea of mediation is essential. It suggests that the management of developmental teaching and learning environments is necessary (John-Steiner & Mahn, 2008). Mediation of learning aims to convert learners' abilities from lower to higher cognitive functions (Kozulin, 2012). Because of this, mediated learning experiences are described as scaffolded learning strategies that lead learners at the pace they have chosen (de Valenzuela, 2009; Wertsch, 2008). According to Vygotsky (1962), language is a psychological and cultural tool. Following Mayana's (2020) study, I asked four community members who were familiar with traditional practices and beliefs on sound and movement to participate in this study. Stott (2016) believed that learning as a mediated process is social in origin and becomes individual as a result of linguistically mediated interaction between the child and more experienced members of society such as parents, teachers and peers. They mediated the transmission of learners' knowledge of *Inkinge* playing into the scientific concepts related to sound using isiXhosa. Language and culture both significantly influence how learning is mediated.

3.2.2 Culture and language

Language and culture are inseparably connected. Vygotsky (1978) places a strong focus on culture and believes that it offers thinking-mediating skills. In general, a distinct language designates a particular population as an individual learns language by referring to individuals around them. Language develops as a vital instrument for establishing personal and social connections as well as a vital cultural transmitter. To Vygotsky, all high-order mental processes, including reasoning and problem-solving, are mediated by psychological tools such as signs, symbols and language (Woolfolk et al., 2008). Therefore, a co-construction study of a language bridge is necessary for a dialogue to take place between learners. The process by which language learners pick up a new language is crucial for understanding and cognitive growth. The IKCs were able to join in actively since they were giving presentations in the language of the learners. While learners learn new languages at school, social contact also happens during official and informal learning. Vygotsky (1978) believes that meaningful learning is enhanced when learners learn through social interactions with materials from their culture. Mukwambo et al. (2014), in support of Vygotsky's seminal work, agree that the theory suggests recognising the cultural elements and practices of learners and leveraging these to facilitate effective learning processes. I believed this might help learners understand science concepts better as they interacted with the IKCs throughout the demonstrations.

3.2.3 Social interactions

We behave and respond to people around us through social contact. Vygotsky (1978) says that social contact is the cornerstone of learning and development. The fundamental importance of social interaction in the development of cognition is noted by Vygotsky's theories (Vygotsky, 1978) that the world is a social space where individuals interact to negotiate meaning. He consequently suggests that community plays a crucial role in the process of meaning-making. Vygotsky believed that learning takes place through social interactions with peers or knowledgeable others (parents, teachers or other learners). In this study, when the IKCs told stories about sound and movement using traditional instruments to the learners, they were likely to contribute to the learners' learning experiences. Social interactions formed in this study, showing how the Grade 4 learners interacted, participated and learned (or not) during storytelling and practical demonstrations of sound and movement by the IKCs were captured. It was felt that learners might enter their ZPD through social contact.

3.2.4 Zone of proximal development

According to Vygotsky (1978), the ZPD is the space between the current level of development as shown by autonomous problem-solving and the following level of development. Through problem-solving with adults or with more experienced peers, the potential level of growth is assessed (Stott, 2016). Furthermore, Stott (2016) emphasises that no ZPD exists prior to a learning activity. She maintains that social connections and ZPD creation go hand in hand. All participants in an activity should make important contributions for the ZPD to be met. In other words, social interactions enable ZPD and self-regulation (Chaiklin, 2003). In this study, the practical demonstrations of using traditional musical instruments were good examples to use to explore higher-order thinking skills that the participants could acquire.

3.2.5 Double stimulation

The concept of double stimulation, rooted in Vygotsky's (1978) work, refers to a process where individuals or collectives are exposed to two conflicting or complementary stimuli that lead to expansive learning and transformative actions (Kaup & Brooks, 2022; Sannino, 2015; Sannino & Laitinen, 2015). This concept suggests that when individuals encounter conflicting motives, ideas or challenges, they are prompted to engage in a process of cognitive conflict resolution and transformative action (Morselli, 2019). Within the field of education, teachers and social educators use double stimulation to facilitate learning experiences or trigger expansive learning (Kaup & Brooks, 2022; Morselli, 2019). It involves presenting individuals or groups with a problematic situation (first stimulus) that creates a conflict of motives or ideas, followed by the introduction of a second stimulus, such as a conceptual tool or mediation, to help resolve the conflict and drive transformative action (Morselli, 2019). By engaging in double stimulation, educational staff can work through conflicts, identify or create auxiliary artefacts as second stimuli and break out of challenging situations to expand learning opportunities (Kaup & Brooks, 2022). This method allows for the development of innovative ideas, concepts, or practices that require collective actions and problem-solving (Sannino, 2015).

This study places immense importance on the concept of double stimulation by integrating cultural music and dance stories into sound learning, as it provides a unique form of dual stimulation. The introduction of these external factors offered learners a socially and culturally embedded experience that engaged them while supporting their internal cognitive processes for enhanced development. Thus, the study aimed to examine how combining such stimuli with

cognitive processing enhances understanding of sound - an alignment with Vygotsky's emphasis on the role of social and cultural factors in such development.

Vygotsky's concepts of social interaction, self-regulation, and the Zone of Proximal Development provided a theoretical lens for analysing the data. Specifically, instances of knowledge co-construction during group activities and engagement with the IKCs were examined through the lens of social interaction, highlighting the role of collaboration in learning. Learners' reflections on their learning process, particularly challenges encountered, and strategies employed, were analysed to understand how self-regulation manifested. Finally, the ZPD concept was used to analyse the scaffolding provided by IKCs and the teacher, identifying instances where learners were supported in achieving learning goals beyond their current capabilities.

3.3 Ogunniyi's Contiguity Argumentative Theory

Contiguity Argumentation Theory (CAT), developed by Ogunniyi (2007a), is an analytical tool that can be applied in situations where two distinct thought processes – such as science and IK – coincide. Govender (2014) asserts that argumentation improves comprehension. In other words, CAT can offer helpful theoretical foundations for examining learners' statements during social interactions. This mobility of thoughts among learners could take place in one of five CAT categories: dominant, suppressed, assimilated, equipollent, and emergent cognitive mental states. Learners encounter dominant conceptions when they claim a phenomenon and back it up with observable empirical facts or convincing explanations. For example, a learner may assert that sound strengthens indigenous peoples' collective identities through music and dancing, and they may also educate others. Furthermore, according to Liveve (2017), indigenous music and dance serve a special purpose in society, expressing communal values and social interactions. They next demonstrate how to move and use traditional instruments to back up their point. The dominant conception may be suppressed or assimilated by a dominant mental system at times.

Emergent conceptions, on the other hand, exist in situations where there are no well-established cognitive structures in learners' minds and a new one must form to cope with a difficult task at hand (Ogunniyi & Hewson, 2008). As a result, the individual has no prior understanding of a notion, which is extremely typical among learners. Finally, the equipollent cognitive state occurs when two conflicting ideas exert equal cognitive force on a learner (Ogunniyi, 2007b).

These two contradictory notions may exist in the brains of learners, and they may coexist without conflict. In this regard, a discourse from this perspective during classroom instruction would assist learners in unlocking the various other views.

The contiguity learning hypothesis was proposed by Ogunniyi (2007a). To discover interactional patterns between learners' local IK and school science, he combined them with contextual constructivism and critical constructivism. As learners try to explain natural events like sound and movement using traditional musical instruments in the context of my study, the CAT proposes that ideas might change back and forth in the learner's head from one cognitive thought to another or from one worldview to another. If the learner has seen or talked about these practices at home, the observed phenomena may be interpreted in terms of the IK worldview from a cultural perspective, or the school science worldview that they study at school. The learner then bases their argument on which worldview they choose based on the context, resulting in the contiguity learning hypothesis.

According to Ogunniyi (2006), the issue of border crossing between learners' IK and school science (Khupe, 2014) needs to be addressed since learners might be stuck in a persistent failure to explain and account for the phenomenon. Learners are involved in argumentation, according to CAT, which may lead to dynamic cognitive consideration of their conceptual position. It is used to examine both logical and non-logical arguments. It is used to resolve misunderstandings caused by two opposing systems of thought. For instance, when learners interact in both scientific and IK debate exercises in class, their thoughts alternate between five cognitive notions.

Furthermore, Hewson and Ogunniyi (2008) argued that the role of conversation space is to facilitate the process of re-articulation, appropriation, and negotiation of diverse worldviews. This is significant for learners because they will need to negotiate meanings across two diverse thought systems to integrate them. The theory posits that there are various methods for learners' concepts to travel within their minds during classroom instruction. As learners listen to each other's arguments, they are likely to reflect on their ideas and, as a result, change their thinking as the argument progresses.

These thoughts may have been formed because of their daily life experiences (Gwekwerere, 2016), beliefs, and IK received from their communities (Kudumo & Ngcoza, 2023; Mateus &

Ngcoza, 2019; Shinana et al., 2021), which may not have been explicitly conveyed to them regarding the occurrence. In this regard, a discourse from this perspective during classroom instruction would assist learners in unlocking the various other views. CAT is consistent with Vygotsky's concept of constructivism, which states that an individual learns or acquires new experiences through interactions with their physical or sociocultural environment. CAT views learning as the product of self or cross-conversation and reflection.

These two theories complement each other; for example, in this study, CAT was used to analyse thoughts that emerged during social interactions, as Vygotsky advises (1978). I had hoped that this would assist me in comprehending learners' inputs during group work social interactions, IKCs' presentations and what they reflected on in their journals. That is why sociocultural theory and CAT were useful theoretical and analytical frameworks for this research.

3.4 Chapter Summary

This chapter provided a comprehensive discussion of the theoretical frameworks drawn upon to support an exploration of Grade 4 farm school learners' learning about sound through cultural music and dance stories. The two main theoretical frameworks employed were sociocultural theory (Vygotsky, 1978) and CAT (Ogunniyi, 2007a). Vygotsky's sociocultural theory was extensively discussed, revealing its underpinning and how it applied to the study's context. Vygotsky's framework was scrutinised from different viewpoints, including mediation of learning, the ZPD and double stimulation, showing how an understanding of cultural activities can facilitate cognitive development and enhance learning outcomes. Furthermore, the chapter explored Ogunniyi's (2007a) CAT, thoroughly analysing its fundamental principles and relevance to this study. CAT argues that learning experiences are interconnected and contiguous, while cultural practices aid in the comprehension of complex ideas. This theory aligns with my research and focuses on using cultural music and dance narratives for effective learning outcomes. The chapter demonstrated how both theories complement each other towards mediating sound education in a culturally enriched classroom setting by complementing each other synergistically.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

Research methodology, a vital component of any study, serves as the backbone for conducting research. It encompasses the strategies and procedures used to collect and analyse data, guiding researchers in effectively answering research questions. Pandey and Pandey (2021) define research methodology as the systematic, theoretical analysis of the methods applied to a field of study. This involves the principles, theories and values that underpin the research process.

In this chapter, the focus is on the research methodology underpinning this study. It begins by elucidating the research paradigms that inform the study, specifically the interpretivist and Indigenous research paradigms. The interpretivist paradigm, according to Snyder (2019), focuses on understanding human experiences and realities, emphasising the subjective interpretation of these experiences. The Indigenous research paradigm, as explained by Mishra and Alok (2022), centres on methodologies and approaches grounded in the unique cultural contexts and perspectives of Indigenous peoples.

Following the discussion of paradigms, the research design employed in this study is outlined. Research design, as Greening (2019) points out, is the overall strategy that a researcher adopts to integrate the different components of the study into a coherent and logical manner. This encompasses the research orientation, objectives, goals and questions that drive the study. The design also includes a narrative of the research site and participants, as well as the methods employed for data collection and analysis. As McEwan (2020) suggests, this part of the methodology is crucial for ensuring the validity of the research findings. In terms of data collection and analysis, Bhardwaj (2019) and Campbell et al. (2020) highlight the importance of choosing appropriate methods and techniques that align with the study's objectives. This includes decisions about the types of sampling as well as analytical procedures, which are pivotal for the credibility of the research.

Finally, the chapter addresses the validity and ethical considerations in the research process. According to Lê and Schmid (2022) and Liamputtong (2020), ensuring the validity of research involves establishing the accuracy and trustworthiness of the findings, while ethical considerations pertain to the principles guiding the conduct of the research. Strijker et al. (2020) and Sileyew (2019) further elaborate on these aspects, noting their significance in maintaining the integrity and quality of the research. The chapter concludes with a summary that encapsulates the methodology and provides an overview of its structural framework. This summary serves as a foundation for the subsequent chapters, linking the methodology to the study's findings and conclusions.

4.2 Paradigms

The research paradigm is the set of philosophical assumptions upon which researchers base their investigations and accept different facts and realities relevant to their field of study (Lincoln & Guba, 1994; Willis, 1995). I employed the Indigenous research paradigm and the interpretivist paradigm in this study which I discuss in more detail below.

4.2.1 Interpretivist paradigm

The research in this study was primarily grounded in the interpretivist paradigm, as outlined by Snyder (2019), who describes it as an approach focused on understanding the world from the perspectives and experiences of individuals. This paradigm was particularly suitable for exploring the nuances of science education in the fourth grade, especially in relation to the concepts of sound and movement. The interpretivist paradigm emphasises the subjective experiences and interpretations of participants, aligning with the study's goal to gain insights into their experiences rather than to alter the educational context itself.

However, as noted by Mutanho (2021), a limitation of the interpretivist paradigm is its tendency to prioritise descriptive accounts over explanatory ones. To address this and provide a more comprehensive understanding, the study also incorporated the Indigenous research paradigm. Chilisa (2012) defines this paradigm as an approach that centres on methodologies and perspectives rooted in the cultural contexts and worldviews of indigenous peoples.

In this study, I, as a researcher, took a keen interest in involving community members in sharing their scientific knowledge with learners and educators. This approach was driven by the observation that elders in the community often lacked opportunities to contribute their

knowledge to the integration of IK in science education. By building rapport and fostering relationships with learners, teachers and community members, I aimed to facilitate the sharing of these valuable knowledge sources.

The inclusion of the Indigenous research paradigm, particularly focusing on the Ubuntu perspective as discussed by Ogunniyi (2008), complemented the interpretivist approach. Ubuntu, a philosophy emphasising humanity and interconnectedness, underscores the importance of community stories and collective wisdom in the educational process. It advocates a respectful and inclusive approach to knowledge sharing, aligning with the broader objectives of the study to integrate Indigenous perspectives into science education. This dual paradigmatic approach enabled a more holistic exploration of the educational experiences and cultural contexts of the participants, enriching the study's findings and implications.

4.2.2 Indigenous research paradigm

The Indigenous research paradigm in this study entailed the inclusion of perspectives and methods that drew from IK, languages, metaphors, worldviews, experiences and philosophies of historically colonised, oppressed and marginalised social groups. Chilisa (2012) outlined this paradigm as an emerging research approach that emphasised the ontologies, epistemologies, and axiologies of indigenous peoples. Within this paradigm, the focus was placed on the Ubuntu perspective, which is more than just a philosophical concept; it promotes the common good of society and offers a unique way of understanding reality. Venter (2004) and Broodryk (2006) regard Ubuntu as a philosophy that stresses collective spirit, emphasising the importance of community, solidarity, caring and sharing.

Echoing these sentiments, scholars like Seehaver (2018) and Adu et al. (2020) define Ubuntu as a feature of human nature that involves sharing, caring, respect and compassion, underpinning a culture that values communality, as discussed by Ogunniyi (2018). Seehaver (2018) further defines Ubuntu as encompassing humanity and humility, aspects that are integral to being and being human. The concept of Ubuntu as a research paradigm refers to the use of Ubuntu, a Southern African lived philosophy or worldview, as a framework for conducting research (Seehaver, 2023).

Seehaver (2023) emphasises the need to decolonise research in the Southern African context, particularly in research involving indigenous ways of knowing and being in the world. He

suggests that Ubuntu as a research paradigm is a stride towards decolonising research and involves grounding methodologies in Ubuntu epistemologies, ontologies and axiologies (Seehawer, 2023). Seehawer (2023) also argues that research in an Ubuntu paradigm should be community-based, relational and participatory while also emphasising that the research agenda, research ethics and methodology should be inseparable and that how research is conducted is inseparable from what is researched and why the research is undertaken. Furthermore, the concept of Ubuntu as a research paradigm aims to contribute to the healing of human-made colonial and ecological conditions locally or globally (Seehawer, 2023).

It thus seeks to recognise the interdependence of humans with other humans, other species and the shared planet and aims to balance these relationships in search of humble togetherness (Seehawer, 2023). In the Ubuntu paradigm, knowledge is produced and verified through collective discourses, a process where different knowledge and stories might emerge as each individual contributes their unique contextual perspective. This worldview advocates a profound sense of interdependence, emphasising that human potential can only be realised in partnership with others.

In this study, we adhered to Ubuntu principles by using clan names instead of pseudonyms, which helped in establishing strong, respectful relationships with participants and facilitated more relational interactions. This approach respected the cultural norms of the participants and allowed for a more authentic engagement. Focus group interviews were also a reflection of Ubuntu, fostering unity, belonging, and a safe space for open discussions. This methodology was integral to the research process, ensuring that the study remained true to the principles of the Indigenous research paradigm and effectively captured the rich, diverse perspectives of the participants.

4.3 Research Design

Maree (2015) describes a research design as a strategy that moves from the underlying philosophical assumptions to specifying the selection of respondents, the data-gathering techniques to be used and the data analysis to be done. Bertram and Christiansen (2015) describe the research design as a plan for conducting the study and analysing the data gathered to address the research question(s). Bertram and Christiansen (2015) also point out that a research plan should explicitly describe what was done with the data once it had been collected. Similarly, a research design is a plan or strategy developed for organising the research and

making it feasible so that the research questions may be addressed with evidence, according to Cohen et al. (2018). In this study, I employed a case study methodology.

4.3.1 Qualitative Case Study

I used the qualitative case study approach because of its suitability for deeply understanding the experiences of Grade 4 learners. As outlined by Bertram and Christiansen (2015) and Creswell (2012), case studies are inherently descriptive and focus on exploring the nuances of specific circumstances. Maree (2014) further emphasises that case studies facilitate a deeper comprehension of the dynamics present within a given situation, offering a comprehensive understanding of the lived experiences of participants.

The specific case examined in this study was a Grade 4 Natural Sciences class in a farm school located in the Eastern Cape. The choice of a case study was apt, given the study's objective to investigate the integration of local knowledge and practices into Grade 4 lessons, particularly focusing on the topic of sound and movement. This approach allowed for an in-depth exploration of the educational context, the teaching methods, and the learners' responses to the integration of IK.

Moreover, the participatory approach employed in this study was consistent with the Indigenous research paradigm. This approach was vital in engaging participants actively in the research process, ensuring their voices and experiences were central to the study. The case study involved a science teacher as a critical friend and four community members knowledgeable in traditional music and dance. Their participation enriched the research, bringing diverse perspectives and expertise to the study.

The case study methodology enabled the use of multiple research methods, enhancing the robustness and richness of the data collected. This multifaceted approach was crucial in capturing the complexities and subtleties of the educational environment and the interactions between the learners, teacher and community members. Overall, the qualitative case study, with its participatory approach, provided a detailed and nuanced understanding of the integration of local knowledge into the science curriculum, contributing valuable insights to the research field.

4.3.2 Research Goal and Research Questions

The main goal of my study was to use stories about cultural beliefs and practices on traditional music and dance to support Grade 4 NS-Tech learners from a farm school in talking about and making sense of the topic of sound.

Research questions

To achieve the above goal, the following research questions will be addressed:

1. What stories about cultural beliefs and practices on traditional music and dance do Grade 4 Natural Sciences and Technology learners from a farm school know from their homes and community?
2. How do the presentations by the Indigenous Knowledge Custodians on stories about the cultural beliefs and practices of traditional music and dance and consolidation thereof enable or constrain Grade 4 Natural Sciences and Technology learners from a farm school from talking about and making sense of the topic of sound?
3. (a)What enables Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound after the intervention?

(b)What constrains Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound after the intervention?

4.3.2 Methodological Approaches

In this study, the participatory approach, a method consistent with the Indigenous research methodology as outlined by Chilisa (2012) was employed. Literature on participatory approaches emphasises their effectiveness in involving participants actively in the research process. Seehawer et al. (2017) argue that such approaches facilitate a more in-depth exploration of participants' perspectives and experiences, ensuring their voices are central to the study. This methodology is particularly relevant when exploring topics deeply rooted in cultural practices and beliefs.

The participatory approach in this study was informed by the Dialogical Argumentation Instructional Model (DAIM) developed by Ogunniyi (2007a). The DAIM facilitated a dialogic

and inclusive environment where different worldviews, particularly those of IK and scientific knowledge, were encouraged to coexist and enhance each other. This approach was critical in helping the class reach a consensus on the value and importance of integrating these diverse perspectives. The aim was to enable learners to recognise the ingrained nature of science in cultural practices, fostering a deeper understanding and appreciation of both.

Consistent with Ogunniyi (2007a), the DAIM emphasises the equality of these two worldviews as a prerequisite for true integration. In practice, this meant involving community members in the educational process where they shared stories and knowledge during science lessons with Grade 4 learners. This method made the scientific topics not only relevant but also deeply meaningful to the learners, aligning with the sociocultural backgrounds of the participants. Mavuru and Ramnarain (2020) support this approach, noting the importance of considering the sociocultural context in educational settings, especially when integrating IK with formal scientific education. Through this participatory approach, the study successfully bridged the gap between traditional IK and the formal science curriculum, enriching the learning experience of the Grade 4 learners.

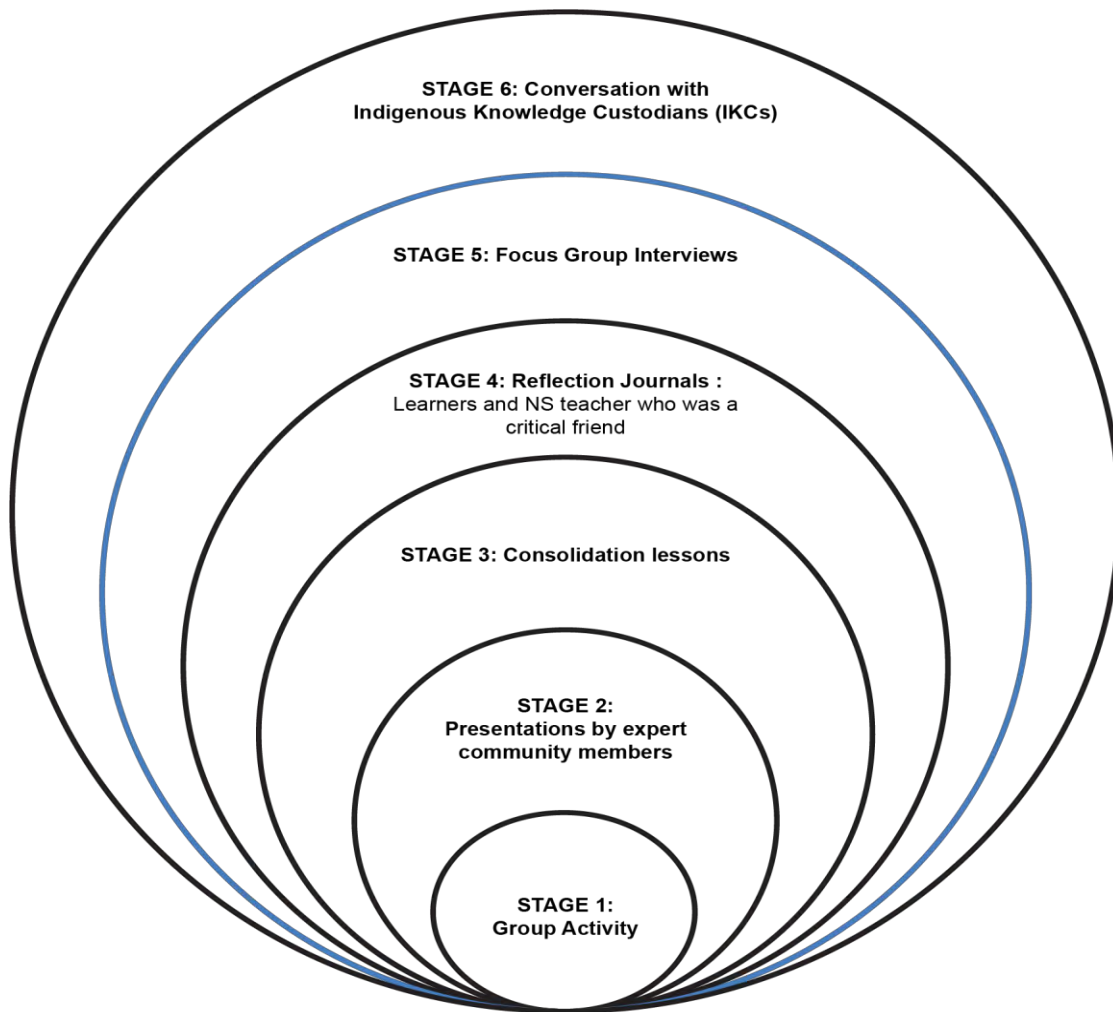


Figure 4.1: The DAIM (adapted from Langenhoven & Stone, 2013, p. 5)

The DAIM was augmented by the Transformative Model of Education for Sustainable Development (TMESD) approach developed by Chikamori et al. (2019). This study was considered suitable for the TMESD framework since creating, executing and refining IK-integrated science lessons are at its core. According to Chikamori et al. (2019), the TMESD framework consists of three learning sub-processes: “future-present”, “past-present relationships” and “knowing the present”. The last two of these focus on how the present is dependent on the past. Retroduction and retrodiction are terms used by these scholars to describe the processes of analysing past-present and future-present linkages, respectively (see Figure 4.1 below).

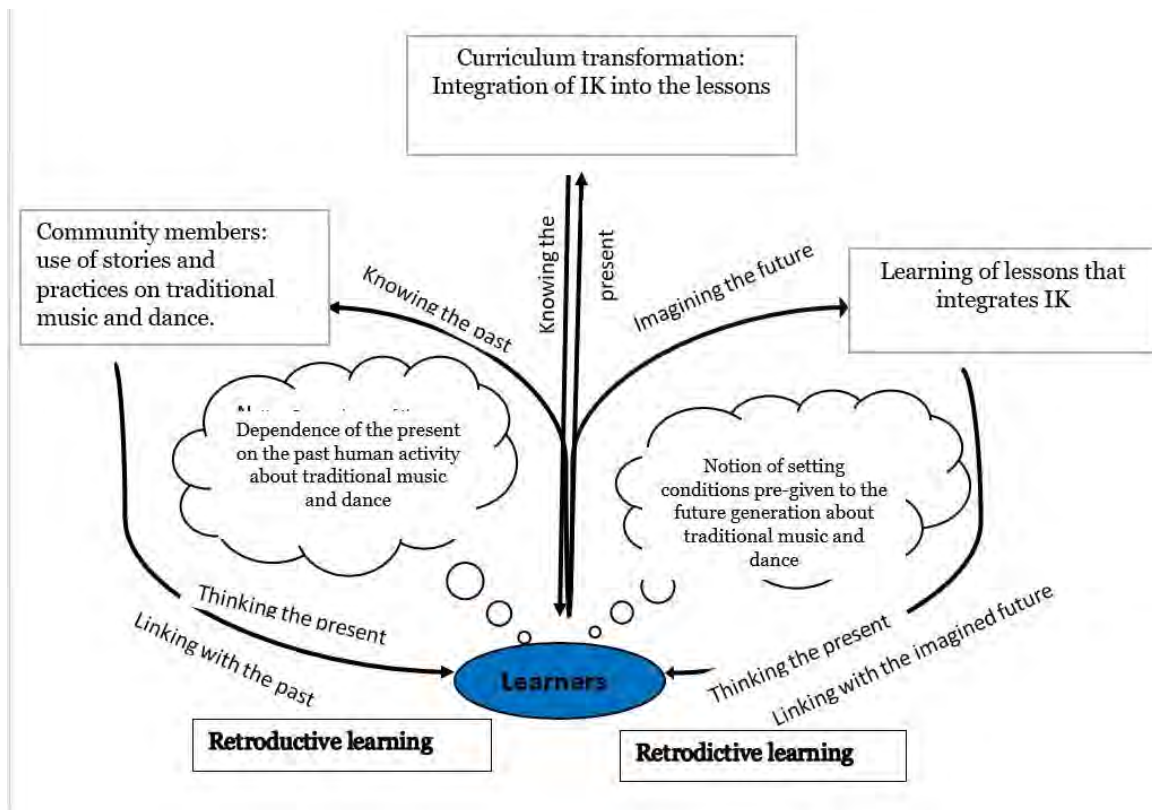


Figure 4.2: Learning process regarding the integration of IK in science lessons (adapted from Chikamori et al., 2019, p. 9)

4.3.4 Research site and sampling

The study was conducted at Siyolise Combined School (pseudonym), a small school situated in a small rural town known as Riebeeck East. The school is in the Makana Municipality, Eastern Cape Province, South Africa (see Figure 3.2). It is located approximately 60 kilometres outside Makhanda en route to Bedford and Cradock. It is the only school in town. It was established in 1994 although the infrastructure has been in existence since the early 1950s.

Currently, the school runs from Grade R to Grade 9. The school's current learner enrolment is 97 learners, six educators (4 permanent and 2 temporary) and one Grade R practitioner. The teacher-to-learner ratio for the farm school, is therefore, 1:14 (rounded off to the nearest whole number). The home language of the learners is isiXhosa (100%), and the languages of instruction at the school are IsiXhosa and English. As was the case in Mavuru and Ramnarain's (2017) study, learners come from diverse sociocultural backgrounds, such as black and coloured townships, as well as surrounding farms. The local community is characterised by a

high rate of unemployment. As a result, parents must find work in town and leave their children with grandparents. The population depends on the government's pension and social grant for income. Hence the school is classified as a ⁵quintile 1 school and learners do not pay school fees. Purposive and convenient sampling methods were applied in this study.

Purposive sampling is the procedure of choosing participants based on traits that make them data holders. For this study Grade 4 learners were appropriate participants as I taught them (Rule & John, 2011). Considering that I already worked with participants I thought that this would make interaction easier. In addition, the syllabus for this grade included the topic of sound and movement. The teacher of Natural Sciences and four knowledgeable community members were also purposively chosen because they were believed to be appropriate and willing to share their cultural backgrounds (Creswell, 2015). For example, the teacher had over 15 years of experience teaching Grade 7 learners in the Natural Sciences. Furthermore, having grown up playing Inkinge and telling stories, the IKCs members were experienced and aware of cultural ideas and practices.

My IKCs had also performed in some shows at the Music Department at Rhodes University. As advocated by Vygotsky (1978), this put them in a more informed position regarding traditional music. Because the goal of the study was not to generalise the findings to a larger population, such as Grade 4 learners in the Sarah Baartman District, the sample size for the study was small. I now discuss the participants in the study, how they were sampled, and my positionality.

⁵ Quintile refers to the classification of public schools in South Africa based on the income levels of the community surrounding the school, with quintile 1 being the poorest and quintile 5 being the least poor.

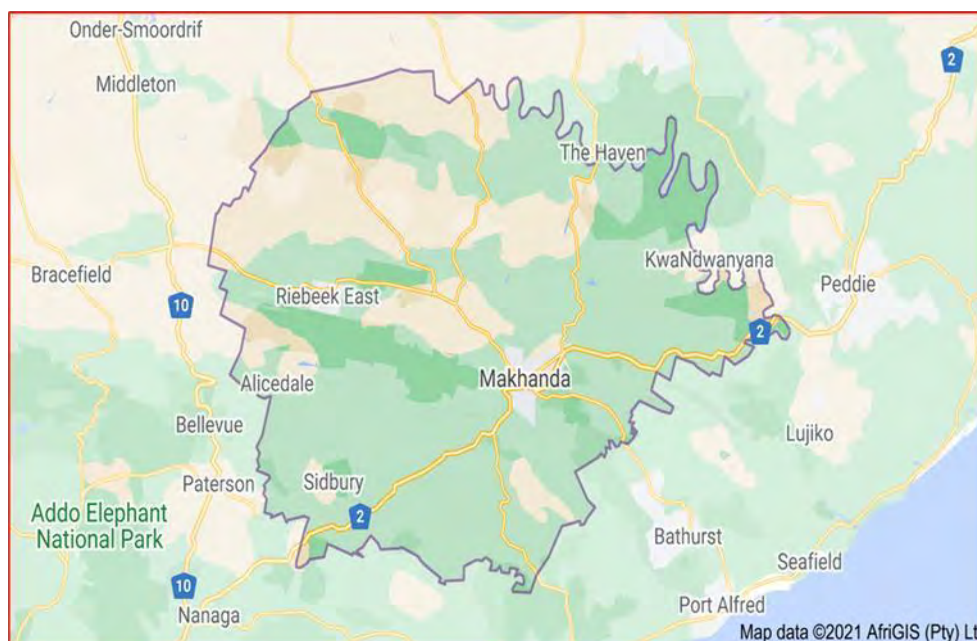


Figure 4.3: The map of Makana where the study occurred
<https://www.google.com/maps/@-33.251148,25.9181339,9z>

Learners

There were three boys and four girls in the group of seven learners in the class. Each learner gave their consent to participate in this study. According to Cimi (2009), learners should be viewed as active participants in their own education rather than as passive recipients of knowledge. In the study, the learners took part as co-researchers, which means I conducted research with them rather than on them. All learners agreed to take part in the research, and both the learners' and their parents' signed consents were obtained.

Table 4.1: Profile of Grade 4 NS-Tech learners

Biographical information	Category	Learners' code	No of learners
Age	7-8	L1F	1
	9-10	L2F, L3F, L4F, L5F, L6M, L7M	6
Grade	Male	L6M, L7M	2
	Female	L1F, L2F, L3F, L4F, L5F	5
Home Language	IsiXhosa	L1-L7M/F	7

Community members

Four Indigenous Knowledge Custodians (IKCs) participated in the study, and they gave me their verbal willingness to participate based on Ubuntu principles. However, to comply with the ethical requirements of a study of this nature written consent was sought, which they gladly signed after I had explained why I needed written consent.

Table 4.2: Profile of the Indigenous Knowledge Custodians

Indigenous Knowledge Custodians	Age	Gender	Highest standard	Home Language	Place of Birth	Other Languages	Role
MamCirha (IKC 1)	93	Female	No formal education	IsiXhosa	Makhanda	English, Afrikaans	Performer
(IKC 2) (Daughter)	65	Female	Diploma	IsiXhosa	Makhanda	English, Afrikaans	Pension
(IKC 3) (Niece)	64	Female	Grade 6	IsiXhosa	Makhanda	English	Caregiver
(IKC 4)	25	Male	BSc Student	IsiXhosa	Makhanda	English	Student

Teacher

I recruited Sanelisiwe (pseudonym), a Grade 7 Natural Sciences teacher, to participate in this study as a critical friend and participant. Sanelisiwe's clan name was MaNkala, and she was born in the Gcibhala area of the Tsomo municipality. According to Özek et al. (2012), a critical friend is someone you can trust to pose thought-provoking questions. Furthermore, these scholars contend that constructive criticism should be fostered and encouraged in the interaction between researchers and critical friends. A critical friend also offers a new perspective and a distinct viewpoint. To advance professionally and for the sake of this study, I was willing to consider any opposing opinions expressed by my critical friend within the parameters of this investigation. She observed every presentation on sound and movement given by knowledgeable community members that integrated IK.

She also participated in the lessons I gave while she watched. *“This study seems interesting, and I would love to participate and see how you integrate IK into your lesson,”* she said. She further reflected that: *“This is the ideal approach for teaching learners”*. There was a reciprocal benefit to taking part in the study; both the teacher and I as the researcher benefitted. Furthermore, I discussed how the lessons went with her in her role as my critical friend, something that was uncommon in our school. At the end of the lesson, we discussed and analysed the field notes she had also taken. The videotaped lessons, her reflections, and her field notes were crucial for the data triangulation. Most importantly, both of us gained knowledge from the presentations made by knowledgeable community members on cultural beliefs about traditional musical and movement practices.

4.3.5 Data-gathering methods

I used four data-gathering methods to answer my research questions, namely, focus group interviews, group activities, observations (videotaped lessons) and journal reflections. I videorecorded these interactions with the permission of the expert community members and the learners. Written permission for all recordings was sought from the learners’ parents or guardians, and from the community members. As explained earlier, the Grade 7 Natural Sciences teacher acted as my critical friend as she was part of the study from the beginning to the end. Every comment or suggestion she made to me was received with appreciation.

Guion et al. (2010) argue that triangulation of data strengthens research and increases the credibility and validity of the data collected. In light of this, Mills (2011) suggests that using different data-gathering methods helps with the triangulation of data. Concurring, September (2016) maintains that these multiple methods might provide more holistic and comprehensive data. Cohen et al. (2018) similarly point out that using a variety of data-gathering methods allows for the gathering of rich data.

4.3.5.1 Group activities

I used group activities like the approaches used by Nuntsu (2020) and Mayana (2020), to create a non-threatening classroom environment. This approach was designed to enable the learners to feel relaxed and free to express themselves, fostering a climate conducive to open communication and active participation. The deployment of this method was influenced by the belief described by Diwu and Ogunniyi (2012) that argumentation and meaningful dialogue

can occur at various levels: intra-individual, inter-group, and trans-whole class. Sedlacek and Sedova (2017) support this view, noting that group activities can significantly enhance active involvement among participants within their smaller groups. The purpose of this activity in their small groups was to gather learners' prior knowledge.

Learners were divided into mixed groups of boys and girls to explore community knowledge about cultural beliefs and practices related to music and dance. The focus of the group activity was on the topic of sound and movement, and each group was tasked with answering specific questions. The questions were designed to elicit responses related to traditional practices, cultural beliefs and the relevance of these aspects to science. The learners' responses were recorded on flip charts and later presented to the rest of the class. Each group was allotted 1015 minutes for discussion, which encouraged concise yet comprehensive explorations of the topics.

The questions posed to the groups were as follows:

1. What are some stories about traditional practices that you know from your homes or community related to sound and traditional musical instruments?
2. What stories about cultural beliefs related to traditional musical instruments and sound do you know from your homes and community?
3. What relevance do you think these stories about cultural beliefs and practices have to science?

As indicated earlier, DAIM was used to guide group discussions in this study. This model not only facilitated the development of learners' communication and analytical skills but also allowed them to connect their learning experiences in the classroom with the knowledge and traditions of their community. During visits to the IKCs, observations and video recordings focused on the interactions and knowledge sharing between learners and IKCs during the sharing circles. These circles centred around the cultural significance of sound within the community, with discussions and demonstrations tailored to complement the themes explored in the group activities. By integrating dialogical argumentation practices with structured instructional components, DAIM fostered a learning environment where learners could engage

in meaningful discussions, build upon each other's ideas, and critically analyze the topic of sound through the lens of their own cultural experiences.

Specifically, the DAIM model was implemented through a three-stage process during the group activities:

1. **Individual Reflection:** Learners were given dedicated time to individually reflect on the questions posed, drawing upon their personal experiences and prior knowledge related to sound and cultural practices. This step reflects DAIM's emphasis on valuing individual perspectives and ensuring that everyone has a chance to gather their thoughts before engaging in shared dialogue.
2. **Shared Dialogue:** Learners took turns sharing their reflections within their groups, ensuring that each member had the opportunity to contribute to the discussion. Guided by DAIM principles, I encouraged active listening and respectful dialogue, prompting learners to build upon each other's ideas and consider different viewpoints.
3. **Critical Analysis and Synthesis:** As learners shared their stories and insights, my critical friend used DAIM-aligned prompts to guide them towards deeper analysis. I encouraged learners to identify common themes emerging from their stories, examine the connections between cultural practices and scientific concepts related to sound, and critically evaluate the relevance of these connections to their own lives and learning. This involved prompts like, "What patterns do you notice in the ways sound is used in the stories we have shared?" or "How can understanding the cultural significance of sound deepen our scientific understanding of its properties?"

By integrating these structured steps, the DAIM model facilitated a more engaging and insightful exploration of the research topic, allowing learners to connect their personal experiences and cultural knowledge with the scientific concepts being studied.

This bridging of school-based learning with IK and practices was a key objective of the study, aiming to enrich the educational experience of the learners and foster a deeper understanding of the subject matter. Learners were given the task of going home and finding information about stories on traditional musical instruments. They then discussed these in their groups and recorded their findings on newsprint. Later they presented their findings in class and discussed them as a class. As part of Ubuntu learners respected each other and were free to engage in their home language which allowed them to speak without restrictions. I will now discuss participatory observations.

4.3.5.2 Participatory observations and videotaping

During the study, participatory observations and videotaping were crucial methodologies employed, particularly during our visits to the IKCs. These visits were characterised by the formation of sharing circles, a strategy that significantly levelled the power gradients between the participants and the research team. Indigenous Knowledge was integrated into the teaching of sound through experiential learning opportunities provided by the IKCs. Learners engaged in hands-on activities and knowledge-sharing circles led by IKCs, directly connecting cultural practices and perspectives on sound with classroom learning.

The concept of sharing circles, rooted in traditional indigenous practices, promotes equity and openness allowing every participant, regardless of their status or role, to contribute equally to the discussions. This approach was instrumental in creating an environment where learners, teachers, IKCs and the research team could interact freely and share their perspectives without any hierarchical barriers. The use of the home language helped my learners as they were free to ask questions and engage with IKCs.

These exchanges demonstrated values that come from the Ubuntu philosophy, including kindness, respect, cooperation and mutual concern. For example, learners questioned the IKCs, addressing them respectfully as '*makhulu*', as it is customary in our society not to question adults. She, in turn, would address them as '*mzukulwana*'. This demonstrated the humanity present in our elderly. Learners were seen taking notes right through the session. This activity lasted approximately 2–3 hours. This observation suggested that the learners were acquiring vital writing skills, essential for their active participation in the activities. Learners seemed motivated and enthusiastic with the involvement of IKCs. My Grade 4

learners were so enthusiastic to learn they were even able to identify science concepts such as sound, low and high.

Videotaping these sessions provided a dynamic record of the interactions, capturing not just the verbal exchanges but also the non-verbal cues and the overall atmosphere of the gatherings. This visual documentation was invaluable for later analysis as it preserved the authenticity of the interactions and provided rich data that could be reviewed repeatedly for deeper understanding and insight.

Participatory observations during these sessions allowed me, as the researcher, to engage actively with the participants, not just as an observer but as a participant in the learning process. This involvement facilitated a deeper understanding of the communal dynamics and the knowledge exchange processes occurring within the sharing circles. Learners were actively engaging with the IKCs and were not scared to ask questions. They were jotting down everything that was said to them. MamMcirha was also enjoying their presence as she asked them to do traditional dancing. The use of participatory observations and videotaping in this manner was pivotal in capturing the essence of the cultural and educational exchanges that took place during the study, providing a comprehensive perspective on the integration of IK into the learning environment.

4.3.5.3 Focus group interview (sharing circles)

In the last phase of the study, focus group interviews also referred to as sharing circles, were employed as a key method for data collection. This approach, resonating with the insights of Chilisa (2012) and Lavalley (2009), was instrumental in gathering rich data and delving more deeply into the learners' understanding. According to Cohen et al. (2018), focus groups are particularly effective in eliciting participant opinions and data through group discussions on a specific topic. In this study, seven learners were interviewed in four separate focus groups, with these meetings conveniently scheduled during their lunch breaks.

Mindful of the potential limitations of focus group interviews, such as the dominance of the conversation by more talkative or confident learners, steps were taken to ensure a balanced and inclusive discussion environment. One significant measure was allowing the respondents to express their opinions in isiXhosa, their mother tongue, which facilitated a more relaxed and free-flowing communication among the participants. This approach was also aimed at

preventing any single participant from overpowering the conversation and ensuring that all learners had the opportunity to voice their thoughts and, if necessary, their dissatisfaction.

The concept of sharing circles was also extended beyond the classroom setting. It was decided that similar sessions would be conducted under a tree at the school, providing a natural and serene environment for the learners to reflect on the entire process. This setting was expected to serve as a form of validation for the learners, allowing them to internalise and articulate their learning experiences more effectively. Moreover, this setting helped to create a non-threatening environment. During sharing circles, we called each other by clan names which encouraged learners to express themselves freely. While their responses were the same to all the questions, I was fascinated by their appreciation of integrating IK into our science lesson as they related to their churches and communities.

It was also deemed important to extend this approach to the IKCs. Inspired by the practices of Liveve (2022) and Simasiku (2022), plans were made to revisit the IKCs to share feedback and insights gathered during the study. This reciprocal exchange of feedback was intended to honour the contributions of the IKCs and reinforce the collaborative nature of the research process. These efforts collectively ensured that the focus group interviews and sharing circles were not only effective in data collection but also in fostering a sense of community and mutual respect among all participants involved in the study.

4.3.5.4 Journal reflections

Meth (2003) claims that keeping journals or diaries can alter the power dynamic between the researcher and participant and provide the researcher with insight into the experiences. Writing in a journal also helps since it gives participants the freedom to discuss whatever they want to when they reflect on their diaries. Journaling is another method used by researchers to document participants' experiences in non-formal learning situations (Falk & Dierking, 2000).

I introduced my Grade 4 learners to writing journal reflections at the end of each lesson by encouraging them to write down everything they thought were the connections between sound, their cultural experiences at the IKCs' home, and the concepts explored during group activities. They started by writing one sentence each day and wrote in their home language which made it easier for them. I was able to obtain the experiences and attitudes of learners about the integration of IK when teaching the topic of sound and movement in this study through journal

reflections. I also found that most of the learners wanted to write in their mother tongue, isiXhosa, and that they were allowed to write in any language that they felt most at ease in. Secondly, I observed that my Grade 4 learners struggled to write in-depth essays and instead chose to convey their emotions with straightforward language, such as “the lesson was enjoyable or interesting”. It was helpful to me because I could see where I could improve. It also helped learners to improve their writing.

4.4 Data Analysis

According to Merriam (1998), data analysis is the process of making meaning of data by combining, reducing and interpreting replies following study objectives. Data reduction is described as the process of selecting, focusing, simplifying, abstracting and transforming data that appear in written-up field notes or transcriptions (Bertram & Christiansen, 2020).

Data analysis was guided by a thematic analysis approach, applied to all data sources including transcripts from group activities, student reflective journals, observation notes from visits to the IKCs’ home, and interview transcripts. Initially, open coding was used to identify emergent themes and patterns within the data. These initial codes were then compared and categorized into broader themes, drawing upon a deductive approach informed by the study's research questions and theoretical framework. This iterative process of moving between data and theory facilitated a comprehensive understanding of the role of IK in teaching sound.

The data were categorised and subjected to inductive analysis by grouping related categories to create themes. Based on their experiences, knowledge, emotions, disagreements and input, the learners’ learning in social interactions was analysed using sociocultural theory. The data were analysed using the lens of Vygotsky’s (1978) concept of social interactions, self-regulation, and ZPD. Furthermore, as an analytical tool, the five elements of CAT – dominant, suppressed, assimilated, emergent, and equipollent ideas – were used (Diwu & Ogunniyi, 2012).

4.5 Validity and Trustworthiness

In enhancing the validity of this research study, notable milestones included presenting the study at both the SAARMSTE (Southern African Association for Research in Mathematics, Science, and Technology Education) Eastern Cape Chapter colloquium and the SAARMSTE

Conference in Bloemfontein. These presentations served as significant validity processes, contributing to the credibility and recognition of the research. Furthermore, the acceptance of a short paper for presentation at the SAARMSTE Conference was a testament to the study's academic merit and relevance to the field of education research.

As highlighted by Creswell and Creswell (2018), establishing validity is crucial in research, as it pertains to the truthfulness or the comprehensive representation of the participants' realities within the study. Cohen et al. (2018) further emphasise the importance of validity in ensuring the veracity of research findings and conclusions. In line with these principles, this study employed various methods to ensure validity, such as data triangulation, which involved using multiple data collection instruments to confirm the accuracy and reliability of the data. This approach, as supported by Cohen et al. (2011), is instrumental in enhancing the trustworthiness of the data collected.

One significant aspect of the research process was the encouragement of participants to behave naturally and authentically during classroom observations and other interactions. This approach allowed participants to express themselves freely and reflect on their practices without the constraints of conforming to the study's objectives. Such an environment of authenticity not only enriched the data collected but also reinforced the study's commitment to capturing genuine participant experiences and perspectives.

Overall, these efforts in presenting at conferences, engaging in data triangulation, and fostering an environment of authenticity significantly contributed to the study's validity, ensuring that the findings were a true and comprehensive account of the participants' experiences and realities in the context of integrating IK into science education.

4.6 Ethical Considerations

Addressing ethical considerations was a crucial aspect of this study, ensuring the research was conducted with the utmost respect for the rights and well-being of all participants. These ethical considerations encompassed several key areas.

4.6.1 Respect and dignity

According to Makabela (2015), researchers ought to be considerate of people and their right to privacy and confidentiality. Thus, I started by giving a detailed explanation of the study's

objectives and how it would help the participants. As the participants signed the informed consent forms, I assured them that their involvement in the study was completely optional and that they could leave at any moment. I made every effort to ensure effective communication and build trust to entice people to take part in the study. This helped to make them feel comfortable working with me. We held all of the activities at convenient locations and times since I respected and kept in mind the participants' schedules. Finally, I got permission from the participants to video record the group activities and the expert community members' presentations, as well as to audio record the focus group interviews. I have saved these videos securely on an external hard disk for five years after the study.

4.6.2 Transparency and honesty

The purpose of the study was made clear to participants long before they signed consent forms and agreed to participate in the study. The consent letters were provided in both IsiXhosa and English so that the participants could understand the study's content. As happened in Mutanho's (2021) study, I found it difficult to translate sentences into isiXhosa. "*You can withdraw from this study at any time if you want to*" Cohen et al. (2018) advise. That comment is difficult to comprehend and unacceptably offensive in African culture. Contradictions between Afrocentric and Eurocentric attitudes can be found in the white counterparts' perception that there is nothing wrong with the statement (Mutanho, 2021; Mwambari, 2020).

Furthermore, approval to perform the study was received from the principal of Siyolise Combined School [pseudonym] and the Eastern Cape Department of Education. Support for this study came from the Natural Sciences teacher, the parents or guardians of the learners, and knowledgeable community members.

4.6.3 Accountability and responsibility

The ethical policy's guiding principles and the rules for conducting education research were followed when conducting the study. As a researcher, it was my duty to establish a supportive atmosphere for the study process. I was also in charge of keeping all the collected data safe. All research instruments and data are stored in a secure location. I also asked my supervisors for their guidance on how to secure this data.

4.6.4 Integrity and academic professionalism

This research project was my own work. I drew inspiration from my own thoughts and, when applicable, acknowledged and referenced the work of others using Rhodes University's referencing requirements. The participants were provided with the recorded data to confirm that the information was accurate. According to David and Resnik (2015), the study was carried out without any political, racial, or religious bias.

4.7 Chapter Summary

In Chapter Four of the thesis, the research methodology underpinning the study was thoroughly outlined and discussed, providing a comprehensive framework for how the research was conducted. Key elements of this chapter included the following.

The study was anchored in interpretivist and Indigenous research paradigms. The interpretivist paradigm focused on understanding the world from the participants' perspectives, especially their experiences with science education in the context of sound and movement. The Indigenous research paradigm added depth by incorporating IK, languages, and worldviews, emphasising an Ubuntu perspective. A qualitative case study approach was employed, deemed most suitable for exploring the interactive nature of the research and gaining a deep understanding of the Grade 4 learners' experiences. This design facilitated an in-depth investigation of the specific case of a Grade 4 Natural Sciences class in a farm school in the Eastern Cape.

The study incorporated participatory approaches, aligning with the indigenous research methodology. This was supported by the DAIM, which facilitated the integration of indigenous and scientific worldviews. The researcher's positionality as a Grade 4 Natural Sciences and Technology teacher and their reflexivity throughout the study were acknowledged. This included a focus on the cultural, ethnic, language, gender and other dimensions of the researcher's identity, influencing the research process.

Multiple data-gathering methods were used, including focus group interviews (sharing circles), group activities, participatory observations, and videotaping. These methods enriched the data collection process, ensuring a comprehensive understanding of the participants' perspectives. The data were analysed using an inductive-deductive approach, categorising and grouping data to form themes. The analysis was framed by Vygotsky's sociocultural theory and the CAT.

The study's validity was enhanced through presentations at the SAARMSTE EC Chapter colloquium and the SAARMSTE Conference in Bloemfontein. Data triangulation and honest participant engagement further contributed to the study's credibility. Ethical considerations were meticulously addressed, including respect and dignity, transparency and honesty, accountability and responsibility, informed consent, cultural sensitivity, beneficence and nonmaleficence and data protection and confidentiality.

In summary, Chapter Four provided a detailed account of the research methodology, encapsulating the paradigms, design, approaches, positionality, data collection methods, data analysis, validity, and ethical considerations. This comprehensive methodological framework laid the foundation for conducting a rigorous, ethically sound, and culturally sensitive research study.

CHAPTER FIVE: GROUP PRESENTATIONS AND PRESENTATIONS BY INDIGENOUS KNOWLEDGE CUSTODIANS

5.1 Introduction

The study aimed to use stories about cultural beliefs and practices in traditional music and dance to support Grade 4 NS-Tech learners from a farm school to talk and make sense of the topic of sound. In the methodology chapter, I discussed the research design and methodology I used in this study and described how data were gathered to address the research goal and research questions. In this chapter, I present a summary of the analysis and discuss data generated from the observations during the learners' group activity and the presentations made by the four expert community members. This chapter aims to answer research questions one and two:

- *What stories about cultural beliefs and practices on traditional music and dance do Grade 4 Natural Sciences and Technology learners from a farm school know from their homes and community?*
- *How do the presentations by the expert community members on stories about the cultural beliefs and practices of traditional music and dance and consolidation thereof enable and/or constrain Grade 4 Natural Sciences and Technology learners from a farm school from talking and making sense of the topic of sound?*

I start this chapter by presenting the learners' responses arranged by their age, gender, grade and language. I also describe their diverse schooling experiences.

5.2 Summary of Qualitative Data Generated During the Group Activity

I gave each of the two groups in the group activity the task of gathering data about local customs and cultural beliefs, such as those pertaining to traditional music and dance. As previously mentioned, and in line with Mayana's (2020) and Nuntsu's (2020) research done in South Africa, learners were given three guiding questions to concentrate on and use as a guide for

their group discussions. This helped to ensure that the data generated from the group activity were pertinent to the study. The learners had time in class to discuss their data in groups and then record their conclusions on newsprint.

Table 5.1: Keys and pseudonyms used in data discussion

Learner 1-7 Male/Female	L1-L7M/F
Group 1-2	Masibambane Group (MG), Guitars Group (GG)
Reflections	RL1-RL7

Learners were given codes such as LM1 - which means male learner number 1 - and the others were given LF2 - which means female learner number 2 - and so on. After the group discussions (see Figure 4.1), each group presented their findings to the entire class as shown in Table 5.1.



Figure 5.1: MG discussing

Figure 5.2: MG presenting

2. What stories about cultural beliefs related to traditional musical instruments and sound do you know from your homes and community?
3. What relevance do you think these stories about cultural beliefs and practices have in science?

They recorded their experience in the newsprint. One member of the group presented their work which led to discussion with their classmates.

Table 5.2: Their responses are recorded below

Question	Group 1	Group 2
1.	<p><i>Xa kuphuma amakhwenkwe kuculwa amagwijo ngabantu. Kuphekwa utywala, kungquzwe ingoma ethi kunzima ukweluka.</i></p> <p>When the boy come from initiation school we sing <i>amagwijo</i>.</p>	<p><i>Xa kugqutha kududuma kuzakunetha kuphunywa phandle kubethwe amazinki kuthiwe embo embo eemboo!</i> When there is a strong wind and there is a storm people go outside the house, beat the zinc and sing <i>embo embo eemboo</i>.</p>
2.	<p><i>Kuculwa ngoba kuphuma amakhwenkwe entabeni, xa kuphuma igqirha kukhaliswa isigubhu.</i></p> <p>They beat drums when witchdoctor is graduating.</p>	<p><i>Xa kuphuma amakhwenkwe kuculwa lengoma ehoo!</i></p> <p><i>Ehoolehoo! Kunzima ukweluka.</i> When the boys come from initiation school they beat different types of traditional musical instruments and sing a traditional song called ehoo! Ehoolehoo!</p> <p>Kunzima ukweluka bhubesi.</p>
3.	<p>Inxulumene nenzululwazi kuba izandi nee instrument sifunda ngazo kwibanga lesine, futhi nezi indijinasi zikhona emakhaya It is connected because sound and instruments are taught at school and we have these indigenous at home.</p>	<p><i>Zinxulumene ngokuba izululwazi iye iphume emakhaya ethu. Naxa kuswelekiwe esikolweni kunculwa iingoma zecawe ziyacula nasemakhaya awethu.</i></p> <p>They are relevant because some of our parents are telling us that we must not make too much noise because it can damage our eardrums.</p>

5.3 Learners' Perceptions of Indigenous Knowledge and Science

The teaching and learning processes within classrooms are significantly influenced by learners' perceptions and understandings of the subject matter. This section explores the perceptions of Grade 4 learners regarding the use of IK in the context of learning about sound in science, as well as examining their pre-existing conceptions of sound that inform those perceptions.

Learners come into the science classroom with a rich tapestry of experiences relating to sound, which are shaped by their environment, culture and daily interactions. Discussions with learners revealed that their conceptions of sound were largely practical and rooted in their cultural practices. For many, sound was associated with communication, entertainment and community activities, such as conversations, music, dance and traditional ceremonies. Even the findings from the group activity revealed that “*Xa kuphuma amakhwenkwe kuculwa amagwijo ngabantu. Kuphekwa utywala, kungquzwe ingoma ethi kunzima ukweluka*” (When the boys come from initiation school, we sing *amagwijo*).

These culturally informed conceptions of sound serve as an anchor for learners to connect with the scientific properties and principles of sound explored in the classroom. For instance, when a community elder demonstrated the traditional instrument called *uHadi*, learners related the tension of the string and the resonance of the calabash to the loudness and desired pitch, linking familiar experiences to scientific ideas of frequency and amplitude.

5.4 The Interplay of Cultural Practices and Scientific Understanding

In this section, we explore the intricate interplay between cultural practices and scientific understanding, shedding light on the dynamic relationship between these two realms within the educational context.

5.4.1 Cultural narratives relating to sound

Sound is not merely a physical phenomenon but is also deeply embedded within the cultural fabric of society. The data collected from the learners demonstrated that their understanding of sound is heavily influenced by cultural narratives. These narratives possess rich descriptions of traditional practices, ceremonies and daily activities where sound plays a critical role, such as the use of drums in community celebrations or the ululations that mark momentous

occasions. These stories inform the learners' perceptions of sound beyond its scientific properties, imbuing it with social, emotional and cultural significance.

Parallel to this, literature underscores the importance of cultural contexts in science education. Iseke (2013) highlights storytelling as an essential means through which indigenous peoples convey their experiences, knowledge and worldviews, revealing that storytelling encompasses much more than entertainment; it transmits values and cultural knowledge. The cultural narratives are echoed in the works of Kuhlane (2011), who insists on the significance of integrating learners' prior knowledge with new information within the academic setting, emphasising that cultural practices may serve as a familiar platform for exploring scientific concepts.

5.4.2 Practical understanding of sound through local instruments

The practical demonstrations of traditional musical instruments, such as *uHadi*, underscore the learners' ability to relate these practices to their understanding of sound in a scientific context. Liveve (2017) provides a relevant framework for this approach by highlighting the role of traditional instruments in generating sound and how the production and transmission of cultural knowledge can be done through sound. The learners observed that the tightness of a string would affect the pitch; they also discovered that the material and shape of an instrument could alter its timbre. These observations align with Liveve's discussions on the construction and sound production of drums and other instruments in cultural settings.



Figure 5.7: Learners learning to play *Inkinge*

Figure 5.7 shows learners enthusiastic to see ⁶MamCirha playing this instrument when asked by Mqocwa: “*Makhulu ndicela usifundise ukudlala uhadi?*” (Grandmother, can you please teach us to play uhadi?). Therefore, the learners' hands-on experience with these instruments cultivated a practical understanding of science principles, like vibration and wave patterns, leading to a more nuanced appreciation of the concepts introduced in the classroom. This is supported by the literature, which addresses the role of experiential learning in understanding scientific phenomena (Liveve, 2022; Mayana, 2020). The observations also resonate with the findings of Idamoyibo (2016), who underscores the educational potential inherent in African traditional music as a vehicle for conveying knowledge through sound.

5.4.3 Bridging cultural practices with scientific concepts

The integration of IK in the teaching of sound facilitates the bridge between cultural practices and scientific concepts. This is evident in instances where community members, acting as IK custodians, shared their knowledge with learners. Such interactions exemplify the dynamic process delineated by Mkabela (2015) and Mavuru and Ramnarain (2017), identifying IK as local knowledge derived from direct interaction with the environment and passed down through generations.

Bringing these IK narratives into the classroom, learners found relevance in the scientific principles when anchored in the context of familiar cultural instruments and practices. For example, discussions about the role of ⁷*iselwa*, a traditional resonator used to increase the volume of instruments such as *uHadi*, provided a concrete example to cement the learners' understanding of amplification and resonance.

⁶ MamCirha agreed for her photograph to be used and said that she is very proud to be part of this study.

⁷ *Iselwa* is a traditional resonator.



Figure 5.8: MamMcirha fixing *Uhadi*

The successful bridging of cultural practices with scientific concepts requires an exploration of the varying ways learners connect IK narratives to science content. These connections were illustrated in the interviews, where learners stated that the inclusion of IK in science lessons gave life to the scientific principles they were learning by situating them within the context of their own cultural experiences. As Mushayikwa and Ogunniyi (2011) and Naidoo (2007) note, the integration must be systematic, providing a scaffold that respects the integrity of both the IK narratives and the scientific principles.

The positive outcomes of integrating IK practices with scientific learning align with the literature suggesting that local knowledge enhances comprehension and bridges cultural divides within the classroom (Aikenhead & Jegede, 1999; Mukwambo et al., 2014). By illustrating the scientific notion of sound through the lens of cultural practices, educators can use IK as a stepping stone to make complex scientific theories more accessible and immediate to learners. This approach feeds into a broader call for a decolonised, diverse inclusive curriculum that considers the cultural milieu of learners, as advocated by Le Grange (2008) and Seehawer (2018).

The integration of cultural practices and scientific understanding demonstrates a vital pedagogical synergy within the science classroom. The narratives, experiences and insights brought forward by the learners suggest that when cultural instruments and traditions are interwoven with the principles of sound in the NS-Tech curriculum, learning becomes a more engaging and coherent experience. This inclusive approach deepens the learners' connection to the scientific content, extending learning beyond the scientific facts to encompass the cultural significance attached to the concept of sound.

Engaging with IK within the educational process not only counters the monocultural tendencies of traditional science education but also fosters a sense of belonging and validation among learners from diverse backgrounds. This research adds to the body of knowledge that supports the integration of IK in science education, echoing the advantages highlighted in the literature while acknowledging the transformative power of storytelling and cultural context in scientific learning. In this light, the narrative of sound in science education should be harmonised with the diverse cultural tunes that learners bring to the classroom.

5.5 Community Engagement and Multigenerational Learning

In this section I delve into the crucial role of community engagement and multigenerational learning, illuminating the profound effect of collaborative community involvement on enriching educational experiences across generations.

5.5.1 Role of Indigenous Knowledge Custodians

The significance of IKCs within the educational landscape was evident in their instrumental role as transmitters of cultural heritage and facilitators of learning. The presence of community members who shared their expertise provided a direct link to the traditions and knowledge that have been preserved across generations. As put forth in the literature by Kibirige and Van Rooyen (2006), IKCs are more than just knowledge bearers – they are the cultural conduit that allows for the seamless passing down of indigenous wisdom that is otherwise at risk of being lost in modern educational contexts.

Learners' interactions with the IKCs not only reinforced cultural pride but also introduced real life applications of scientific concepts through traditional practices. This phenomenon aligns with the findings of Liveve (2017) and Liveve (2022), who emphasise the intersection of cultural practices and scientific learning. Drawing on these engagements, learners were able to

witness firsthand the principles of sound as demonstrated through the development and use of traditional instruments, offering demonstrations that brought abstract concepts to life.



Figure 5.9: MamMcirha and her grandson demonstrating how to play musical instruments

Furthermore, IKCs played a crucial role in providing an authentic experience that went beyond the mere transmission of knowledge, fostering a deeper understanding of cultural identity and its connection to science. This role resonates with Mavuru and Ramnarain (2017), who recognise the value of incorporating the breadth of IK – not just its cognitive aspects – into learning environments to enrich educational experiences.

5.5.2 Transmission of cultural knowledge through family narratives

The study revealed that family narratives served as a rich source of cultural knowledge and were integral to learners' comprehension of sound within their cultural context. Through stories from parents, grandparents and other relatives, learners inherited a multifaceted understanding of the role sound plays in their culture, from its use in communication and storytelling to its incorporation in rituals and celebrations.



Figure 5.10: MamCirha dancing for the learners

These family narratives, as described in the literature by Nhase and Dube (2023), are a foundational tool for teaching and learning, which, when coupled with formal education, significantly influence children's learning opportunities as shown in the previous figure. The narratives shared in classroom settings brought a sense of kinship and shared history to the learning of science, enriching the learners' educational journey and providing an anchor to root scientific concepts in a familiar context.

5.5.3 Community presentations as learning opportunities

Community presentations were highlighted as invaluable opportunities for collaborative learning and engagement. In these sessions, learners were not passive recipients but were encouraged to participate actively by asking questions, sharing their own stories, and drawing parallels to their lived experiences. Learners portrayed that they knew the terms MamCirha was using like sound and volume. Throughout the session, learners were writing down what MamCirha was saying. Such participatory learning opportunities align with Vygotsky's (1978) sociocultural theory that emphasises learning as a social process, with understanding being constructed through interaction.



Figure 5.11: Learners writing in their exercise books

These presentations acted as a space where learners were able to bridge the gap between IK and scientific knowledge in a synchronised manner. When IKCs demonstrated instruments like *uHadi* and discussed their construction and acoustical properties, science principles presented earlier in textbooks became tangible. Sedlacek and Sedova (2017) support this by recognising that learning becomes more meaningful when learners can actively give meaning to new information based on their existing knowledge base.

Community presentations became a nexus for cross-generational learning, reflecting a shared ethos of knowledge as a collective good. Moreover, they compellingly illustrate the principles of scaffolding by encouraging learners to ascend from their current knowledge level toward higher levels of understanding, supported by the guidance and shared knowledge of the IKCs which endorses the value of communally held knowledge (Klein, 2011).



Figure 5.12: Learners dancing for IKC members

Community engagement and multigenerational learning emphasise the expansive nature of education, specifically within the realm of IK integration in science classrooms. The role of IKCs, the transmission of knowledge through family narratives, and the use of community presentations underscore the fact that learning about sound is not confined to the pages of a textbook or the walls of a classroom. Instead, it is a dynamic confluence of experiences that traverse age, space and time.

This section not only supports the integration of IK in science education through enriching learners' experiences and knowledge but also confronts the challenges of preserving cultural heritage in an increasingly globalised world. The findings corroborate the literature which suggests that the inclusion of IK and active engagement of IKCs in education is paramount to developing a holistic and inclusive curriculum. Such a curriculum not only educates but also celebrates the diverse cultural legacies that learners bring to the academic environment.

5.6 Learners' Engagement with Science Through Indigenous Knowledge Narratives

In this section, I examine the influential role of IK narratives in shaping learners' engagement with science, exploring their responses to IK integration in the science curriculum and the cognitive associations between school science and home and community knowledge.

5.6.1 The influence of Indigenous Knowledge narratives on learner engagement

The infusion of IK narratives into the science curriculum had a pronounced impact on learner engagement. When the cultural music and dance narratives were integrated into the teaching of sound, learners displayed heightened interest, participation and motivation in the science class. This is consistent with the literature, where scholars such as Le Grange (2007) and

Sedlacek and Sedova (2017) suggest that engagement increases when learners encounter material they can relate to on a personal and cultural level.

The storytelling approach seemed to encourage a more holistic engagement with the subject matter. As posited by Bruner (1990), stories have a unique ability to draw in the listener, prompting deeper cognitive and emotional investment in the content being shared. In line with Chilisa (2012), the stories told by IKCs not only entertained but also carried pedagogical impact by immersing learners in a culturally resonant learning environment that stimulated their intellectual curiosity.

5.6.2 Learners' responses to Indigenous Knowledge integration into the science curriculum

Responses to the integration of IK into the science curriculum were overwhelmingly affirmative among learners. Interviews and classroom observations indicated that learners found science more understandable and relatable when underpinned by IK. They appreciated the validation and acknowledgement of their culture within the academic space, aligning with the perspectives of Mukwambo et al. (2014), who emphasise the potential of IK to enhance cultural validation in education.

However, a few learners expressed concerns over potential misinterpretations of integrating IK with science, reflecting the challenges highlighted by Horsthemke and Schafer (2007) regarding the unexamined adoption of IK. Despite this, learners predominantly responded with enthusiasm to the opportunity to bridge school science with culturally familiar narratives and practices.

5.6.3 Cognitive associations between school science and home/community knowledge

The creation of cognitive links between school science and home/community knowledge stands at the core of the educational experiences described by the learners. They shared instances where they drew parallels between the scientific explanations of sound and the musical experiences from their cultural background. This reflects their ability to synthesise diverse sources of knowledge to form a more coherent understanding of scientific principles.

In particular, the narratives shared by IKCs enhanced the learners' capacity to associate scientific concepts such as pitch, frequency, and amplitude with sound production in traditional musical instruments and practices. This interpretive layer added depth to their learning, as

reinforced by the infusion of IK into scientific instruction, validating the assertion by Kuhlane (2011) that learners' prior knowledge plays a significant role in knowledge acquisition.

5.7 Challenges and Opportunities in Integrative Pedagogy

The endeavour to integrate IK into the science curriculum presents a range of challenges and opportunities. This process requires a nuanced approach that recognises the complexities of blending two distinct epistemological systems without misrepresenting either.

One notable challenge was the potential for misunderstandings and misuse of IK. As Horsthemke and Schafer (2007) caution, the uncritical acceptance of all IK can perpetuate misconceptions and stereotypes. Misrepresentation can stem from oversimplification, decontextualisation, or the romanticisation of indigenous practices. For example, describing traditional musical instruments solely in the context of their sound production capabilities may fail to convey their full cultural and ceremonial significance, leading to a superficial understanding that detracts from the rich heritage they represent.

Furthermore, there is a risk that IK can be misused as a mere pedagogical tool, stripped of its cultural and spiritual meaning, which is integral to its authenticity. This potentially undermines the very objective of integrating IK, which, as Kibirige and Van Rooyen (2006) posit, involves enhancing education through cultural relevance and acknowledgement of a diverse range of worldviews.

Addressing these challenges involves creating spaces for open dialogue where misconceptions can be identified and rectified. It requires educators not only to impart IK but also to engage in continuous learning about the cultural contexts of the knowledge shared. This reciprocal educational process aligns with Vygotsky's (1978) sociocultural theory, which emphasises the importance of social contexts in shaping cognitive development.

Another challenge in integrative pedagogy is the language barrier, as scientific concepts are often introduced in a language that may not be the learners' first language. This was observed in the study, where the transition from teaching in isiXhosa to teaching in English made understanding scientific terms difficult for learners. The integration of IK presents an opportunity to overcome language barriers by contextualising scientific vocabulary and concepts within learners' cultural and linguistic frames of reference.

Against this challenge, IK integration enables a bilingual education approach where learners can explore scientific concepts through both the language of formal education and their home language, supported by their community's cultural narratives. As Liveve (2022) notes, the use of traditional musical instruments in teaching sound provides a platform for introducing scientific jargon in a manner that is tangible and relatable. Furthermore, Lemke (2001) suggests that learners gain a more profound understanding of scientific concepts when they are taught using familiar cultural and linguistic contexts.

The opportunities for enhancing learner participation and understanding through IK are manifold. Integrative pedagogy provides a pathway for learners to become agents of their own learning who actively connect classroom knowledge with home and community experiences. They participate more freely in class discussions, drawing upon their cultural background and bridging it with the science curriculum as supported by scholars who advocate increased learner agency in learning (Aikenhead & Jegede, 1999).

The process of integrating IK also provides an avenue for honouring and revitalising local wisdom and practices, which can contribute to fostering a sense of cultural identity and pride among learners. This is especially important in societies with colonial histories, where IKS have often been marginalised or overlooked within formal education systems. By bringing IK narratives into the classroom, educators can validate these knowledge systems and promote their preservation for future generations.

Moreover, the presence of IK custodians within the educational setting is an invaluable resource, providing an authentic and authoritative voice to cultural discourse within the science curriculum. Researchers such as Kuhlane (2011) have argued that such community engagement in education encourages a symbiotic relationship where the school benefits from the community's knowledge, and the community sees its practices and worldviews valued within formal educational contexts.

5.8 Themes Arising from Data Analysis

In this section, I present and discuss the main themes that emerged from the data analysis, including the relevance of IK to science education, Pedagogical Implications of IK Integration, Learner Engagement and Sense Making, Community as a Source of Science Learning, as well as The Role of Language in Science Learning.

5.8.1 Theme 1: Relevance of Indigenous knowledge to science education

The relevance of IK to science education emerged as a salient theme throughout the primary data collection phase. The findings illustrated how integrating IK within the science curriculum enriched learners' educational experiences, provided culturally resonant educational resources, and made scientific concepts more accessible and relevant.

5.8.1.1 Using local knowledge as an educational resource

Learners' experiences indicate that local knowledge was a potent educational resource that, when used appropriately, could significantly contribute to their understanding of scientific concepts. The IK narratives drawn from the learners' community contexts brought forth a wealth of information that complemented the formal science curriculum and provided a familiar terrain for exploring new knowledge.

For instance, the sounds of traditional instruments and the techniques for their creation and play resonated with learners, connecting theoretical scientific concepts covered in the classroom to tangible practices from their daily lives. For example, Mfene said, *"I enjoyed this lesson because the teacher was referring to the things we know from our homes like at home we know about drums"* (see Appendix J). This connection proved successful in advancing learners' comprehension of sound through the act of making and manipulating traditional instruments such as drums and stringed apparatus. Inviting IKCs to lead these interactions brought an authoritative voice and authenticity to this knowledge, making it an invaluable educational resource.

Literature on the topic, including the works of Kibirige and Van Rooyen (2006) and Semali and Kincheloe (1999), underlines the wealth of knowledge embedded within local cultural practices. The data showed this to be true, underscoring the role of interactive activities, such as community members demonstrating the construction of a traditional guitar, and elucidating principles such as tension and resonance in a way that textbooks could not.

5.8.1.2 Making science accessible and relevant

Integrating IK into the science curriculum also made scientific concepts more accessible and relevant to learners. The use of familiar cultural examples to illustrate scientific principles helped demystify complex ideas, making them more approachable for learners. For example,

the concept of sound waves became less abstract when learners observed sound production in a drum, linking the vibrations they could feel with the sounds they could hear. The connection between home and community knowledge and school science not only made science more accessible but also more relevant, as supported by the findings of Aikenhead and Jegede (1999), who advocate the integration of learners' life worlds with school science to facilitate learning. Learners reported a newfound enthusiasm for science when they could see direct links between what they had learned at school and the knowledge they had inherited from their cultural backgrounds.

One learner's account of comparing the sound phenomenon discussed in class with the experience of listening to the echoes of traditional songs sung by their elders was an example of such relevance in action. This interfacing of cultural knowledge with formal education presented science as an integral part of everyday life rather than an isolated academic pursuit. The use of IK narratives in the classroom also made science education more inclusive, ensuring that learners from various cultural backgrounds saw their native wisdom represented and valued. This inclusivity, which aligns with UNESCO's endorsements of culturally responsive education, served not only to engage learners but also to affirm their identities within the learning environment.

5.8.2 Theme 2: Pedagogical implications of IK integration

The integration of IK into science education carries profound pedagogical implications. This theme delves into how this integration can enhance conceptual understanding through cultural contexts and addresses the challenges of bridging epistemological divides.

5.8.2.1 Enhancing conceptual understanding through cultural contexts

The findings revealed that embedding cultural contexts within science teaching significantly enhanced learners' conceptual understanding. When scientific concepts were articulated through the lens of IK – be it the crafting of musical instruments, the recognition of natural phenomena, or agricultural practices - learners demonstrated a firmer grasp of the underlying principles. A cultural lens provides an opportunity for learners to connect theoretical knowledge with practical, observable phenomena, deepening their understanding.

For instance, the concept of frequency became more tangible when related to the tightening of a drum skin, an activity familiar to many learners through cultural celebrations. As Nhase and Dube (2023) suggest, such storytelling and practical experiences lay the groundwork for subsequent scientific learning, providing an integrative approach that synthesised formal science education with informal, culturally rooted knowledge.

The use of IK narratives aligns with Vygotsky's (1978) theory, which states that cognitive development is a socially mediated process. When educational content is grounded in learners' social and cultural experiences, it creates a ZPD where learners can navigate new concepts with the support of culturally relevant cues. This cultural contextualisation engages not just the cognitive but also the affective domain, addressing the holistic development of learners as suggested by Kuhlane (2011) and Dunn (2001).

5.8.2.2 Challenges in bridging epistemological divides

Despite the benefits, the integration of IK poses challenges in bridging epistemological divides. This relates to difficulties in reconciling IK's holistic, often oral and experiential nature with the formal, structured, and written form of scientific knowledge traditionally favoured in educational settings. The data indicated varied perceptions among learners regarding the legitimacy and value of IK as compared to Western science, a tension echoed in the literature by Horsthemke and Schafer (2007) who provide a critical lens on the conflicts between different knowledge systems.

Misalignment and misunderstandings can arise if educators are not adequately prepared to navigate and integrate the two epistemologies in their teaching practice. Bias, insufficient background knowledge, or a lack of proper resources and institutional support can lead to superficial engagement with IK, resulting in an ineffective integration that fails to meet educational goals. This limitation underlines the need for teacher training and curriculum development that squarely address the interplay of different knowledge systems as highlighted by Mushayikwa and Ogunniyi (2011).

Furthermore, addressing potential scepticism among learners and educators about the value of IK in scientific discourse is imperative for successful integration. Education systems with histories of prioritising Western scientific methods may find resistance to giving equal credence to IK frameworks. Overcoming this scepticism requires clear communication and a

demonstration of the unique insights and perspectives that IK can provide in understanding natural phenomena.

5.8.3 Theme 3: Learner engagement and sense-making

The third significant theme of the study centres on learner engagement and sense-making in relation to IK narratives. It delves into the importance of learner talk as a cognitive tool and explores how cultural participation facilitates active learning. Data for this came from learners' group activities (see Section 4.3.3.1 for more details).

5.8.3.1 Learner talk as a tool for cognitive development

The data collection phase of the study highlighted the significance of learner talk, or discourse among learners, as a catalyst for cognitive development. This aspect of learning is profoundly influenced by the sociocultural theory of Vygotsky (1978), which posits that meaningful learning occurs through social interactions and dialogue. Engaging in talk about IK narratives allowed learners to organise their thoughts, articulate their understanding, and challenge or confirm their conceptions with peers and instructors.

In classroom settings where learners discussed the sound properties of traditional instruments or shared personal anecdotes about experiences with sound, there was considerable evidence that learner talk enabled them to draw connections between theoretical knowledge from the curriculum and their own lived experiences. Learners who explained to their peers how different pitches could be created in traditional songs or instruments were actively using language to scaffold their learning, aligning with Vygotsky's concept of the "More Knowledgeable Other".

This subtheme is supported by Lemke (2001), who suggests that learner dialogue is essential in the process of making sense of science. When learners are encouraged to speak in the classroom, particularly about concepts linked to their cultural background, they have a reflective space to internalise scientific concepts and construct new knowledge, as highlighted in the literature by Gwekwerere (2016).

5.3.8.2 Active learning through cultural participation

The integration of IK narratives in the study facilitated active learning by involving learners in cultural participation, such as re-enacting dances, playing traditional instruments or singing cultural songs that related to their lessons on sound. This approach reinforced the connection between cognitive understanding and physical experiences with sound. Active learning through cultural participation served to ground scientific concepts in real-world contexts, making them more comprehensible and less abstract. It enabled learners to experience the physics of sound wave propagation, frequency and amplitude through tangible engagement with the cultural practices they are familiar with. The literature review by Liveve (2022) supports this finding, highlighting the significance of movement and music in the deeper understanding of sound production.

Furthermore, the opportunity to participate in cultural activities in the classroom went beyond academic learning. It also fostered social skills, cultural identity, and self-efficacy among the learners. These active participation experiences are in line with the findings of Nhase (2019) who suggests that embedding science within Life Skills, such as the cultural activities of music and dance, provides opportunities for introducing basic science concepts in a manner that is enjoyable and relatable to learners.

5.8.4 Theme 4: Community as a Source of Science Learning

The fourth key theme that emerged through the participatory observations (see Section 4.3.32 for more details) is the recognition of the community as a vital source of science learning. The integration of community resources, particularly IKCs, and the value of intergenerational transmission of knowledge, offer significant opportunities for enhancing science education.

5.8.4.1 The educational value of indigenous knowledge custodians

The data underscored the critical role played by IKCs in providing a living bridge between educational theory and community wisdom. These custodians brought a wealth of experience and knowledge into the classroom, rendering scientific concepts more concrete and culturally grounded. Their presence and participation in science lessons added credibility to the IK narratives and conveyed a sense of authority that textbooks alone could not provide. As Mqocwa said, *“I think bringing local knowledge in our science lessons will be great because I will connect it with to make sense of the topic”* (see Appendix I).

An important subtheme here was the ability of IKCs to contextualise scientific learning within the cultural practices and history of the community. For example, when IKCs explained the process of creating musical instruments from local materials, they linked physical science concepts like sound resonance and material properties to the daily lives and traditions of the learners. This reaffirmed the insights from UNESCO (1999) and Mkabela (2015), who discuss the expansive, localised nature of IK and its potential as an educational resource.

5.8.4.2 Intergenerational transmission of knowledge

Another subtheme emerging from the study was the significance of intergenerational transmission of knowledge in science learning. This transmission occurs when traditional knowledge, skills, and customs are passed down from elders to younger members of the community, strengthening cultural continuity, fostering a deep sense of identity, and belonging.

This phenomenon resonates particularly in the context of science education when understanding is enhanced through stories, examples and practices passed on within families and the larger community. The study highlighted instances where learners brought stories from their grandparents into classroom discussions, linking these narratives to scientific phenomena they were studying. This intergenerational aspect was shown to deepen their conceptual grasp, as it embedded science learning within a framework of cultural heritage and collective memory.

From the perspective of pedagogy, the appreciation and use of intergenerational knowledge in science learning is invaluable. It accords elders and community members a meaningful role in the educational process, aligning with Vygotsky's (1978) suggestion that social interactions and the sharing of experiences are imperative for cognitive development. It also aligns with findings by scholars like Seehawer (2018) who highlight the vast storerooms of cultural and historical knowledge contained within generations which can enrich science teaching and learning.

5.8.5 Theme 5: The Role of Language in Science Learning

Language plays a crucial role in facilitating science learning, and this study's fifth theme explores how IK and bilingual education are employed to navigate and enhance the linguistic dimensions of scientific understanding.

5.8.5.1 Encountering scientific vocabulary through indigenous knowledge

Scientific vocabulary often presents a significant hurdle for learners, particularly for those for whom the language of instruction is not their mother tongue. The integration of IK narratives in the science curriculum has been shown to help learners encounter and understand scientific terminology more seamlessly. When these terms are introduced through the prism of familiar cultural practices and instruments, they become anchored in the learners' pre-existing knowledge base, making them more digestible and less intimidating.

For instance, when discussing aspects of sound, terms like “resonance”, “pitch” and “amplitude” are not just abstract scientific concepts but become tangible properties that learners can witness and explore through their interaction with traditional instruments and cultural narratives. As learners discuss these concepts within the context of IK, such as the making of a traditional drum, they actively engage with the vocabulary, applying it directly, which is consistent with the findings of Liveve (2022) on the didactic potential of cultural practices in sound education.

By placing IK at the forefront, educators allow learners to navigate scientific vocabulary within a familiar context, scaffolding their linguistic development and fostering a more inclusive learning environment as highlighted by UNESCO’s advocacy for culturally responsive education.

5.8.5.2 Bilingual education as a means of conceptual mastery

The study also emphasised the potential of bilingual education to aid conceptual mastery in science. Encouraging the use of learners’ first language alongside the language of instruction offered an inclusive approach to understanding scientific concepts. This bilingual strategy supported learners in making cognitive connections between the terminology used in the classroom and the descriptions and observations they knew from their own cultural experiences.

Learners in bilingual settings can discuss and elaborate on scientific concepts first in their home language, gaining confidence and comprehension, before translating and solidifying that understanding into the second language. This process not only facilitates linguistic development but also reinforces scientific learning, as it requires the learner to process the information at a deeper cognitive level to convey it accurately across languages. Aligning with

the perspectives of Nemutanzhela and Makonye (2010), who advocate bilingual approaches in science teaching, learners reported a more profound understanding of scientific concepts when they were able to switch between languages, meshing scientific knowledge with cultural understanding. Such an approach is validated by the works of scholars like Gwekwerere (2016), who recognise the importance of language in contextualising science education within learners' cultural frameworks.

5.9 Implications for Teaching and Learning

The integration of IK into the science curriculum has significant implications for teaching and learning, especially in the context of addressing the linguistic and cultural needs of learners, fostering a conducive learning environment and guiding future curriculum development.

5.9.1 Addressing the linguistic and cultural needs of learners

The incorporation of IK into science education can play a crucial role in meeting the linguistic and cultural needs of learners. Language is not only a medium for communication but also a way of understanding the world, and when science is taught exclusively in a language that is not the first language of learners, it can create barriers to understanding. Integrating IK allows for a bilingual teaching approach where learners can interact with the scientific concepts in their native language, enhancing comprehension and ensuring that learning is not lost in translation.

This approach is particularly important where there is a need to value and preserve indigenous languages and knowledge. By acknowledging and drawing on the linguistic resources that learners bring with them, educators can tap into a rich repository of cultural knowledge and experience that can be harnessed to explain and explore scientific concepts. In this regard, embracing bilingual education acts as a means of bridging cultural divides in the classroom and fostering an inclusive environment where diversity is viewed as an asset rather than a challenge.

To implement this approach effectively, teacher training and curricular materials must be adapted to support bilingual education and the integration of IK. Educators require the skills to navigate between languages and cultural contexts, ensuring that learners can relate to and engage with the subject matter in a meaningful way. Not only does this require pedagogical

sensitivity but also a deep knowledge of and respect for the cultural backgrounds of the learners.

5.9.1.1 Integrating IK to foster a conducive learning environment

The study's findings suggest that the integration of IK into science lessons provides a myriad of benefits that contribute to an environment more conducive to learning. The IK brings a sense of relevance and immediacy to scientific concepts, making them more tangible and understandable for learners. This is because IK narratives often involve hands-on activities, storytelling and community engagement, which can make the science classroom a place of exploration and discovery, resonating with learners on a personal level.

An environment conducive to learning is one where learners feel valued and where their background knowledge and cultural heritage are seen as strengths. The integration of IK effectively allows learners to see themselves and their communities reflected in the curriculum, nurturing a sense of belonging and motivation to engage with the subject matter. When learners are encouraged to bring their own experiences into the classroom discussions, it fosters a space where learning is reciprocal and dynamic, leading to a more engaged and participatory classroom culture.

For educators, this means creating lesson plans that leverage cultural knowledge as a foundation for developing scientific understanding. It requires openness to new ways of teaching that may differ from traditional science education methods. For learning to be truly effective, the environment must support learners from diverse backgrounds, enabling them to integrate new knowledge with their existing worldviews.

5.9.1.2 Future directions for curriculum development

The implications of IK integration extend to future directions for curriculum development. Moving forward, educational authorities and policymakers must consider the importance of culturally responsive pedagogy, which mandates a curriculum that is reflective of the learners' cultural contexts and responsive to their educational needs.

Curriculum development, therefore, should not be a top-down approach but rather a collaborative process that involves community members, educators and learners. This engagement ensures that the curriculum is not only scientifically rigorous but also culturally

relevant and grounded in local knowledge systems. It also suggests the addition of resources that are scaffolded to build upon learners' prior knowledge, incorporating IK narratives and language strategies that enable all learners to participate fully in the learning process.

Moreover, for such curriculum development to be successful, there must be a concerted effort to move beyond the mere inclusion of IK as an additional element within the curriculum to embedding it meaningfully into the core of science education. This involves reimagining how science is taught and ensuring that IK is woven throughout the fabric of the science curriculum rather than presented as an occasional supplement.

5.10 Chapter Summary

This study has revealed the multifaceted implications of integrating IK into the science curriculum for learners in a South African farm school setting. Its primary objective was to uncover the effects of such integration on learners' engagement with and understanding of scientific concepts, particularly those related to the topic of sound. The findings of this research underscore the potential of IK as a valuable asset in the educational domain and offer insights into the future direction of curriculum development.

The integration of IK into science education has demonstrated considerable promise in enhancing learner engagement, facilitating a deeper understanding of scientific concepts, and providing a more inclusive learning experience that validates the diverse cultural heritage of learners. Through the incorporation of IK narratives – especially those related to local music and dance traditions – learners were able to connect abstract scientific principles with the tangible realities of their cultural background. This thematic exploration emphasised the value of learner talk and active participation in cultural activities as effective strategies for fostering cognitive development and promoting a dynamic learning environment.

Challenges were also identified, including the potential for misunderstandings and misuse of IK and the need to navigate language barriers for effective communication of scientific content. However, the use of bilingual education strategies offers a powerful means of obviating these challenges, enhancing conceptual mastery through facilitation in learners' first language and the language of formal instruction.

In light of these outcomes, the integration of IK in the science curriculum can be viewed as transformative, challenging traditional paradigms of education. It demands a reconsideration of how knowledge is presented and learned in the classroom. This approach necessitates that teachers not only serve as conduits of scientific knowledge but also as mediators between the cultural knowledge systems represented by their learners and the academic expectations of the broader educational system. Striking a balance between respecting cultural heritage and meeting the requisites of formal science education is vital. Future curriculum development must be tailored to encompass cultural contexts that are meaningful to learners, promoting increased understanding and cementing relevance to learners' lives beyond the classroom. Teachers play an integral role within this transformative process; they become facilitators of a learning experience that advocates a science education which is holistic, inclusive and representative of our diverse society.

CHAPTER SIX: LESSON OBSERVATION, FOCUS GROUP INTERVIEWS AND LEARNERS JOURNAL REFLECTIONS

6.1 Introduction

This chapter provides a comprehensive analysis of the effectiveness of using cultural music and dance *stories* to mediate the learning of sound among Grade 4 farm school learners. This chapter employed a multifaceted approach, integrating lesson observations, focus group interviews (sharing circles) and learners' journal reflections to gather valuable insights into the factors that enable and/or constrain Grade 4 NS-Tech learners from a farm school from talking about and making sense of the topic of sound.

This chapter aims to answer research questions 3 (a and b):

- *What enables Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?*
- *What constrains Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?*

Lesson observations offered direct observations of learners' engagement and understanding during sound-related lessons, while focus group interviews (sharing circles) provided a platform for in-depth discussions with learners. In addition, learners' journal reflections offered a glimpse into individual thoughts, experiences and insights related to the use of cultural music and dance *stories* in the learning process. Collectively, these data-gathering methods contributed to a comprehensive assessment of cultural elements in the learning of sound among Grade 4 farm school learners. To make the analysis and discussion easier, we used clan names to level power gradients and create a non-threatening environment as shown in Table 6.1 below.

Table 6.1: Data-gathering tools and codes used in data discussion of data in this section

Data-gathering tools	Learners' clan names
Lesson on practical activities	Mqocwa, MamBamba, MamQocwa, MamBathane, MamNgqosini, Mfene, MamJwarha
Lesson that integrated Indigenous knowledge	
Learners' journal reflections	
Focus group interviews (sharing circles)	

6.2 Themes That Emerged from Lesson Observations

In this section, I present and discuss the main themes that emerged from lesson observations. During the observations, learners were tasked with observing me as I presented the cultural beliefs and practices related to sound. The lesson took about one hour. My critical friend (MaNkala) was also there to observe me while I was teaching the lesson I had planned with her. The lesson observations provided an opportunity for the learners to engage with me as I was presenting. These observations were conducted in an authentic cultural setting. As a result, the setting allowed the learners to witness firsthand the role of music and dance in conveying traditional knowledge about sound.



Figure 6.1: During lesson observations

The lesson was centred on the theme ‘*Sound and movement*’. During the lesson, I explained to the learners that traditional musical instruments are complex systems which comprise interconnected parts that work together with the aim of generating specific outcomes. Furthermore, the lesson emphasised that these instruments rely on an input of energy to facilitate their functionality. Learners comprehended that an individual has to provide the necessary energy input for traditional musical instruments to produce sounds. The lesson also underscored that various musical instruments use different forms of movement as input energy, such as shaking, blowing, plucking and hitting, to create sound. Learners were asked to draw mind maps of learned science concepts (Figure 6.2 below).

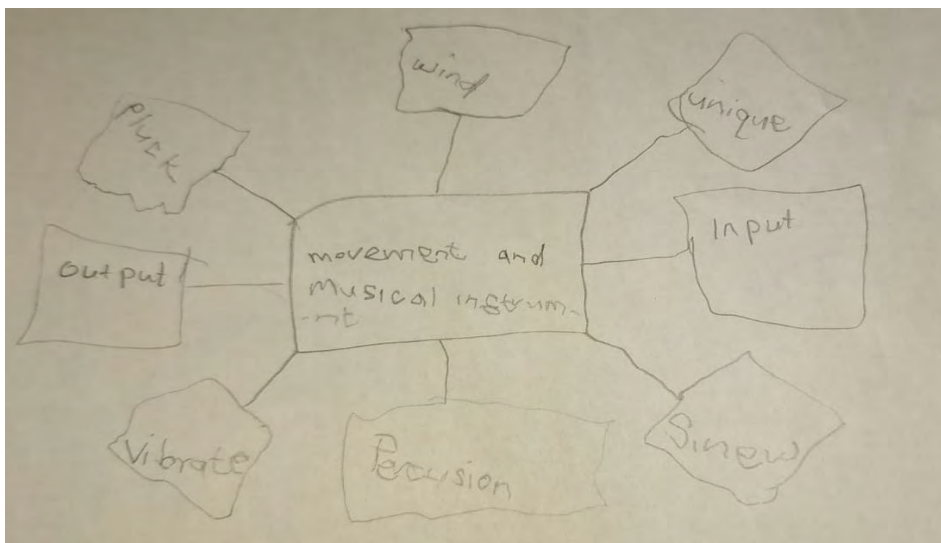


Figure 6.2: An example of a learner’s mind map

Specifically, the main instruments explored included the drum, requiring the movement of hitting or beating; the shaker, reliant on shaking; the tuba, necessitating blowing; and the guitar, reliant on the plucking of strings. Learners were able to match column A with column B (see Appendix K) identifying how the instruments were played (Figure 6.3 below).



Figure 6.3: Shows learners' writing activity

Their last activity was a hands-on practical activity. Learners made different types of musical instruments (Figure 6.4 below) using locally available materials from their homes. This activity provided the learners with a practical understanding of the relationship between movement and sound production, fostering an interactive and immersive learning environment.



Figure 6.4: Learner practical activity

The thematic analysis revealed two main themes that emerged from the observations (as presented in Table 6.2 below), shedding light on the effect of cultural music and dance *stories* in mediating the learning of sound among Grade 4 farm school learners.

Table 6.2: Themes that emerged from lesson observations

Theme	Description
Enhanced learning experience through Integration of IK in Science Education	The incorporation of IK to enrich the learning experience in the context of science education.
Experiential learning through hands-on activities	Learning was facilitated through practical, hands-on activities to provide direct experiences and engagement with the subject matter.

6.2.1 Theme 1: Enhanced learning experience through integration of IK into science

The lesson I presented was on sound and movement. Learners were grouped into two groups. The first had three learners and the second one had four learners. For an ice-breaking activity, I first asked the learners to close their eyes and be quiet. All the windows and doors were closed. I asked them if they heard any sound around them. Mfene responded: “*Ndiva isandi seentaka, kuthulekile apha endlini*” (I can hear the sound of birds, but it is quiet in the classroom). MamBamba excitedly said: “*Mna ndiva isandi semoto*” (I hear the sound of a car). Learners enjoyed this activity as they kept hearing different sounds from outside. They opened their eyes. I told them that sound cannot be seen, but we can hear it. Even if there is no noise in the classroom, we can still hear a noise.

For the second activity, they had to clap their hands softly. Then I asked them: “*What did you hear?*” Mqocwa said: “*Ndiva ukuqhwytywa kwezandla okutsholo ezantsi*” (I hear a soft clapping of hands). I asked them to clap again but this time louder. Then, I asked them what they heard. MamJwarha said: “*Ndiva izandla eziqhwytyayo zenza ingxolo kodwa ndiyasonwabela esi sifundo*” (I hear the loud clapping of hands, but I am enjoying this). I asked if they could relate any of the sounds that they had just heard to their community or home. “*Ewe, ewe ndisifanisa naxa kunomgidi kuculwa, kuqhwytywa kuxhentswa*” (Yes, yes, it is similar to when we have a ceremony we sing, clap hands and do traditional dance) said MamBathane. MamNgqosini added: “*Indikhumbumbuza ecaweni yam*” (It reminds me of my church).

The first theme that emerged from the lesson observation (see Section 4.3.3.2 for details on lesson observation) was the enhanced learning experience through the integration of IK into science teaching and learning. The exemplar lesson I taught on *Movement and musical instruments* aimed to integrate learners' IK of sound with modern science. This approach produced positive results as learners were actively engaged in the lesson. For example, they all wanted to beat the drum and were singing traditional songs. MamNgqosini said: “*Ndiyasonwabela esi sifundo*” (I am enjoying this lesson). Mfene said: “*Singasiphinda esi sifundo, ndizocela umama andifundise ukubetha kakuhle igubhu*” (Can we repeat this lesson so that I can ask my mom to teach me how to beat a drum). This suggests that the use of cultural music and dance *stories* as a medium has the potential to facilitate learning of sound as this significantly heightened their interest and participation. The integration of IK into science education is vital as it allows for the integration of cultural perspectives and traditional wisdom into the learning process.

By recognising and valuing IK, learners are provided with a more holistic understanding of scientific concepts, fostering a sense of cultural pride and identity. This result aligns with the findings by Wilujeng and Prasetyo (2018), who reported that by incorporating IK into science education, students can benefit from a more holistic and culturally relevant learning experience that enhances their understanding of science while also connecting the gap of science education pathways that a student obtains in schools and community. Similarly, Ngai et al. (2010) also highlighted that integrating Indigenous cultures in education can promote intercultural understanding and improve outcomes for Indigenous learners. In the context of the *Movement and musical instruments* lesson, the integration of IK not only enriched the learning experience but also allowed learners to connect with the subject matter on a deeper level, promoting meaningful and contextualised learning. This is in line with Van Zyl et al.'s (2023) study, which underscores that integrating IK into modern science in the form of community-based learning assists students in contextualising and broadening their understanding of communities' health needs and developing collaboration and communication skills. This approach had a positive effect on my learners by creating a sense of cultural relevance and authenticity, thereby enhancing their motivation and engagement in the learning process.

In addition, during the delivery of the exemplar lesson on *Sound and movement*, my critical friend MaNkala was videotaping. After the lesson, she also reflected and highlighted the positive effect of integrating IK into science lessons (Figure 6.5 below).



Figure 6.5: Reflecting on lesson observation with my ⁸critical friend after the lesson

MaNkala further agreed with the approach and mentioned that she would adopt a similar strategy in her classroom. She noted:

The lesson was great. It includes their culture and must not be erased by Western life. Because our learners think Western culture is better than our culture. They undermine their culture, so lessons like these will bring back that dignity to our knowledge. Even by bringing the community members into our classrooms and displaying more, they will understand that if adults know about it and even at school is being taught, that will mean something to them. That will be sustainable for our learners. Even in my classroom, I would integrate IK and bring community members because learners learn more from them. They are the best modellers who will be modelling the reality.

From this excerpt, it could be deduced that MaNkala passionately advocates the preservation and integration of IK into education, emphasising its vital role in restoring cultural dignity, combating the prevalent perception that Western culture supersedes indigenous traditions and instilling a sense of dignity and pride in learners regarding their own knowledge systems. Her insight underscores the importance of incorporating community members into the educational process, highlighting their influence as role models and their capacity to impart authentic, experiential knowledge to learners. MaNkala's perspective emphasises the importance of

⁸ My critical friend agreed for her photograph to be used in the thesis and indicated that she is blessed to be part of this exciting study,

integrating IK into science education to counterbalance the dominance of Western-focused science content with contextually relevant knowledge from communities. Furthermore, the literature highlights the potential of integrating IK to enrich science education and improve educational outcomes for Indigenous students who have long been underrepresented in current education systems (Jin, 2021). Similarly, Handayani (2018) noted that the inclusion of IK in the science curriculum provides a new perspective on science learning and contributes to cultural sustainability. In addition, the integration of IK can promote scientific literacy and enhance the relevance and authenticity of science learning materials (Rajagukguk et al., 2020; Parmin & Fibriana, 2020).

Bernardi and Santos (2021) also reported that the integration of IK into the science curriculum has positive effects on learners, such as increasing their self-esteem and providing a greater appreciation of traditional culture. Therefore, the integration of IK into science education aligns with contemporary educational perspectives that emphasise the value of culturally responsive and inclusive pedagogical approaches.

6.2.2 Theme 2: Experiential learning through practical and hands-on activities

The second theme that emerged from the lesson observation (see Section 4.3.3.2 for details on lesson observation) was experiential learning through hands-on practical activities. During the lesson on *Sound and movement*, I brought musical instruments, including drums and *uhadi* to my classroom. Learners actively participated in playing and experimenting with the instruments. Learning was facilitated through hands-on practical activities to provide direct experience and engagement with the subject matter (Asheela et al., 2021). The learners' active engagement and visible signs of enjoyment during the lesson underscored the effectiveness of experiential learning.

For instance, when asked what they enjoyed about the lesson, MamBathane enthusiastically replied: “*Ndonwabele ukudlala uhadi kuba inika isandi esihle!*” (I enjoyed playing the uhadi because it makes a beautiful sound!). Mqocwa added: “*Ndikonwabele ukudlala igubu nokumamela isifundo*” (I enjoyed playing the drum and listening to the lesson). These responses highlight that the use and importance of hands-on practical activities in the *Sound and movement* lesson. By promoting active participation (Sedlacek & Sedova, 2017), experiential learning enhances learners in their understanding of sound production and fosters a sense of excitement and curiosity about the topic. Moreover, by providing direct experiences

through hands-on activities, learners were able to explore and interact with musical instruments, thereby gaining a deeper understanding of the principles of sound and music. This approach not only catered to diverse learning styles but also facilitated a more profound and memorable learning experience by enabling learners to internalise abstract concepts through tangible experiences. Furthermore, the enjoyment and enthusiasm displayed by the learners during the practical activities indicated a heightened level of motivation and engagement, contributing to a more authentic learning experience.

Previous studies have also emphasised the value of experiential learning through practical activities in promoting learner engagement and understanding. For instance, research by Sumarmi et al. (2020) demonstrated that experiential learning models enhance learners' learning scores. Furthermore, a case study by Voukelatou (2019) demonstrated the significant impact of experiential learning on acquiring knowledge and developing social skills, contributing to the promotion of cultural heritage and traditional values in secondary education. Lê and Tran (2023) also found that experiential learning in the context of teaching the Vietnamese language in primary schools effectively encourages learners to analyse and apply knowledge to real-world situations. Moreover, Murray (2018) emphasised that experiential learning is an educational orientation aimed at integrating theoretical and practical elements of learning.

6.3 Themes That Emerged from the Focus Group Interview (sharing circle)

In this section, the focus is on exploring the themes that emerged from the focus group interview (sharing circle). This was conducted as part of the study on mediating the learning of sound through cultural music and dance *stories* to Grade 4 farm school learners. Following the classroom observations, I proceeded with the focus group interview, engaging the learners with seven questions. The main goal of the focus group interview was to gain a deeper understanding of the learners' perspectives and experiences, aiming to identify emergent themes and patterns that could enrich the overall analysis.

Notably, the focus group interview adopted the model of a sharing circle rooted in Indigenous methodologies (Chilisa, 2012; Lavalée, 2009). We sat under the tree (see Figure 6.6 below) creating a circle of dialogue and respect where everyone's voice was valued and heard (refer to section 4.3.3.3 for a detailed discussion about the focus group interview). This approach

fostered an atmosphere of communal dialogue and collective wisdom, and the natural environment not only provided a relaxed atmosphere conducive to open conversation but also resonated with the Indigenous practices central to the study's objectives. In doing so, this approach honoured the cultural traditions and values of the learners, promoting a sense of belonging, empowerment and inclusion.



Figure 6.6: Showing the sharing circle under a tree

During the sharing circle, and as alluded to earlier, we used clan names to level power gradients and to create a non-threatening environment. This is in line with the Ubuntu perspective, which holds that people should be treated equally in terms of their beliefs, needs and opinions (Ogunniyi, 2018; Seehawer, 2023). As a result, learners participated freely during the sharing circle. Through the analysis of the focus group interview data, two main themes emerged, shedding light on the learners' engagement and the valuable insights gained from their perspectives.

Table 6.3: Themes that emerged from the focus group interview

Theme	Description
Integration of Indigenous Knowledge into Science Lessons	Acknowledgement of the potential benefits of integrating IK into science lessons to enhance comprehension and relevance.
Community Involvement in Knowledge Acquisition	Acknowledgement of the role of communities, including parents, as valuable sources of knowledge to bridge the gap between formal education and community-based wisdom and expertise.

6.3.1 Theme 1: Integration of Indigenous knowledge into science lessons

The integration of IK into science lessons was acknowledged by the learners as having the potential to enhance comprehension and relevance. The sharing circle (see Section 4.3.3.3 for details on sharing circles) revealed that learners felt more connected to scientific concepts when these were embedded within the context of their cultural practices. They reported experiencing a sense of relevance and immediacy that textbook learning on its own seldom invoked. The IK narratives turned abstract scientific concepts into tangible phenomena, transforming the role of learners from passive recipients of information to active constructors of knowledge.

The integration of IK into science lessons was generally met with positivity and enthusiasm by the learners. It became clear that learners appreciated the relevance and familiarity that IK brought to their science lessons. For instance, Mqocwa reflected: *"Inzululwazi ivakala kakuhle xa kuxutywa nezinto esizaziyo emakhaya"* (Science makes more sense when it talks about things we know from our home). Previous studies have also underscored the importance of integrating familiar real contexts and IK into lesson activities to stimulate learners' interest and curiosity to learn new concepts. For instance, Onwu et al. (2020) advocated a "two-eyed - seeing" approach, emphasising the significance of engaging learners in activities that introduce them to familiar real contexts. Furthermore, the integration of IK into science education has been shown to contribute to sustainable development by considering the potential of the local environment and the wisdom of Indigenous populations (Romualdo et al., 2022). This

integration is also aligned with the goal of supporting educational success for Indigenous learners, as it makes educational programmes more culturally responsive and relevant (Jin, 2021).

Learners viewed the integration of IK as an opportunity to bridge the distance between their lived experiences and the conventional, often abstract, science curriculum. They indicated that seeing their culture reflected within the science education framework not only piqued their interest but also empowered them by validating their backgrounds and experiences. *“When MamCirha talked about how she learned to play the uHadi from her grandmother, it made me see that our own stories are important too”*, Mfene reflected during the sharing circles.

They also expressed that integrating IK into science lessons would facilitate better understanding and provide a sense of connection to the subject matter. For instance, MamQocwa mentioned that bringing IK into science lessons would be great as it would help them connect and make sense of the topic. She noted, *“I believe integrating local knowledge into our science lessons would be beneficial as it would help me connect with the topic, making it easier to understand”*. Mambathane added: *“It could also simplify science lessons for those of us who were finding it challenging to grasp the concepts”*. In addition, MamNgqosini noted: *“Integrating local knowledge in teaching the topic of sound makes it easy for us to connect and understand science”*.

However, learners also expressed some doubt and concern regarding how the integration of IK could be perceived by outsiders. They seemed to be worried that embracing IK in science education might lead to doubts about the consistency and modernity of their curriculum. For instance, MamQocwa hesitantly pointed out during a group activity: *“Abanye abantu bangacinga ukuba asifundi Nzululwazi yamanyani”* (Some people might think we’re not learning real science).

Despite this concern, the overall attitude towards integrating IK into science lessons was positive. Learners described a sense of pride in seeing IK being treated with the same respect and significance as Western scientific knowledge. They believed that this more inclusive approach to science education could facilitate a better understanding of both their cultural heritage and scientific concepts, which aligns with the main idea of the “two-eyed seeing” of Onwu et al. (2020), emphasising the significance of engaging learners in activities that introduce them to familiar real contexts. By expressing a strong belief in the positive impact of

integrating IK, the learners demonstrated an understanding of the value of connecting their cultural and community experiences with the academic content. This aligns with contemporary educational research that emphasises the importance of culturally responsive teaching and the benefits of integrating Indigenous perspectives to promote enhanced understanding and relevance within the learning process (Bottiani et al., 2018; Herrera, 2022; McKoy & Lind, 2022; Zidny et al., 2020).

6.3.2 Theme 2: Community involvement in knowledge acquisition

The data collected through focus group interviews (see Section 4.3.3.3 more for details) revealed that another key theme that emerged from the responses was learners' perceived relevance of knowledge from their home and community environments when learning about specific topics, such as sound. A study by Webb (2013) aimed to investigate the perceptions of teachers, pupils and community members regarding the importance of isiXhosa IK, its relevance to education and how it could be incorporated into the science curriculum. The study findings reported that people are very aware of the relevance and value of IK in education. Similarly, the evidence from the learners' responses supports Webb's (2013) findings by highlighting the importance of incorporating community members in the science classroom and promoting hands-on practical activities and visualisation. Learners recognised that local knowledge is instrumental in shaping their understanding of the topic.

For instance, MamJwarha emphasised the familiar sounds heard in their environment, correlating them with the scientific concepts discussed in class. Similarly, another learner pointed out the direct link between the sounds from their community and the subject matter taught in school. These observations not only showcase the learners' acute awareness of the practical application of sound-related concepts in their immediate surroundings but also underscore the palpable influence of community involvement in shaping their educational experiences (Demssie et al., 2020; Lema & Mwila, 2022; Watson et al., 2017). It further exemplifies the learners' holistic understanding of the harmonious relationship between their lived experiences and formal education. This emphasises the intrinsic value of integrating IK and community involvement into our science lessons. It could be surmised that this is congruent with previous studies emphasising the significance of integrating learners' lived experiences and community knowledge into the academic curriculum to promote meaningful learning

experiences and foster a deeper understanding of scientific principles (Baharin et al., 2019; Gwekwerere, 2016; Nortvig et al., 2018; Ryu et al., 2019).

6.4 Themes That Emerged from Learners’ Reflective Journals

Learners were given reflective journals to promote introspection, reflection and structured expression of their thoughts, feelings and insights. This reflective exercise aimed to capture learners’ viewpoints, experiences and reactions to the learning process, thereby providing valuable qualitative information on their unique paths of acquiring knowledge. Three main themes emerged from these reflective journals, offering a window into the complex range of their introspective musings and subjective experiences.

Table 6.4: Themes that emerged from learners' reflective journals

Theme	Description
Cultural Sound and Instrument Knowledge	Learners demonstrated an understanding of different types of sounds and instruments, including traditional and modern ones.
Integration of Indigenous Knowledge in Modern Science	Learners expressed enjoyment in examples related to their home environment and IK, reflecting the integration of traditional elements into the lesson.
Community Engagement and Involvement	Emphasises the importance of community involvement and the integration of traditional knowledge for an enriched learning experience.
Emotional Impact of Loud Sounds	Learners expressed discomfort and pain caused by loud sounds, indicating the emotional impact of excessive noise levels on their learning environment and well-being.

6.4.1 Theme 1: Cultural sound and instrument knowledge

The first theme that emerged from the learners’ reflective journals (see Section 4.3.3.4 for more details) was cultural sound and instrument knowledge. Learners expressed their understanding of different types of sounds and instruments, including drums, guitars and traditional instruments like *uhadi*. This demonstrates their assimilation of cultural sound and instrument knowledge. For instance, Mqocwa articulated: “*Ndifunde ukuba zininzi iintlobo zesandi, ezixuba nezi igubu ezenziwe emakhaya, ikatari kunye zezinye*” (I have learned that there are

many different types of sounds, and that includes drums made at home, guitars, and any other instruments). MaMbamba shared her understanding of how sound travels and their enjoyment of the examples related to IK: *“Ndifunde ukuba isandi sihamba njani nokuxhentsa”* (I have learned how sound travels and how to dance). In addition, learner MamBathane added: *“Ndifunde ukuba impempe inesandi esiphezulu ukudlula zonke”* (I have learned that a whistle has the loudest sound of all instruments).

The above learners’ statements highlight the profound significance of culturally sound knowledge in the learners’ educational journey can do. It underlines the pivotal role of cultural heritage in shaping their understanding of music, sound and traditional instruments, thereby fostering a deep connection to their cultural identity. By embracing and internalising culturally sound knowledge, the learners not only enrich their academic experience but also cultivate a sense of pride, respect and appreciation for their heritage. Research has shown that appreciating diverse cultural backgrounds among students is associated with increased motivation and a deeper connection to cultural heritage, instilling cultural pride and sensitivity (Bautista et al., 2022). Moreover, Ismailov (2021) also highlighted that intracultural learning, which involves learning about one’s own culture and socio-linguistic norms, helps learners explore their cultural heritage and identities, fostering a deeper understanding and appreciation of their heritage.

6.4.2 Theme 2: Integration of Indigenous knowledge into modern science

Another main theme that emerged from the learners’ reflective journal (see Section 4.3.3.4 for more details) responses was the integration of IK into modern science. Learners appreciated the integration of examples related to things they have at home and see in the community. They emphasised the relevance and interest in integrating IK into their learning experiences.

For instance, MamNgqosini noted: *“Ndisonwabele isifundo kuba utitshalakazi ebesenza imizekelo ngolwazi lwemveli. Lonto yenze isifundo sanomdla”* (I enjoyed this lesson because the teacher was making examples about IK. That made the lesson interesting). Mfene also added: *“Ndisonwabele esi sifundo kuba besifaka izinto endizaziyo emakhaya; umzekelo emakhaya siyawazi amagubu”* (I enjoyed this lesson because the teacher was referencing the things we know from our homes; for example, at home, we know about drums). MaMbamba highlighted: *“Ndisonwabele imizekelo yesifundo kuba bekuxutywa nezinto esinazo emakhaya”* (I have enjoyed the examples of the lesson that were related to the things we have at home).

The learners' positive responses and suggestions emphasise the importance of embracing and integrating IK into educational curricula. This aligns with previous studies showing that integrating Indigenous perspectives not only enhances learners' understanding of their cultural heritage but also promotes a more holistic and inclusive approach to learning (Alexiades et al., 2021; Demssie et al., 2020; Zidny et al., 2020). By acknowledging and integrating IK, educators can create a learning environment that is more engaging and relevant to learners' lives, fostering a deeper connection to their cultural identity (Alexiades et al., 2021; Diano et al., 2023). Conversely, these findings contradict Horsthemke and Schafer's (2007) assertion, who argue that learners tend to think of IK as outdated.

6.4.3 Theme 3: Community engagement and involvement

The third main theme that emerged from the learners' responses (see Section 4.3.3.4 for more details on learner reflective journals) was the need for community engagement and involvement in the lessons. The learners emphasised the importance of community involvement and the integration of traditional knowledge for an enriched learning experience. They suggested involving older individuals, such as grandmothers and knowledgeable community members to enhance the learning of traditional instruments and IK. They clearly indicated the desire for community engagement and the recognition of the value of traditional wisdom within their educational journeys.

The following responses were recorded when the learners were asked how this lesson could be improved. MamBamba responded by saying: "*Ngokubiza umakhulu, angasinceda sifunde ezinye izinto*" (By bringing my grandmother, she can help us learn more things). MamNgqosini added: "*Ngokubiza abantu abadala bazosifundisa*" (By calling older people to teach us other things). MamJwarha also noted: "*Ngokumema abantu abanolwazi basekuhlaleni*" (By inviting the knowledgeable person in our community).

The learners' emphasis on community involvement and the integration of traditional knowledge underscores the significance of integrating community perspectives and expertise into the educational process. Their suggestions to involve elderly community members, such as grandmothers and knowledgeable individuals in the learning of traditional instruments and IK revealed a strong desire for a more comprehensive and culturally enriched learning experience. This highlights the importance of community engagement in shaping a curriculum that is not only academically rigorous but also culturally relevant and inclusive.

By integrating community knowledge and expertise, teachers can foster a learning environment that honours and respects the cultural traditions and heritage of the learners, promoting a sense of belonging and pride in their identity. This is in line with the studies by Cocks et al. (2012) and Smith (1999), who discussed the concept of cultural revitalisation, which emphasises the significance of integrating community knowledge and expertise in educational environments to honour and respect cultural traditions and heritage. Their work underscores the role of education in fostering a sense of belonging and pride in learners' cultural identity, aligning with the idea that incorporating IKS and cultural practices can contribute to cultural revitalisation and empowerment within educational settings (Cocks et al., 2012; Smith, 1999).

Research has also shown that including community perspectives and traditional wisdom in the curriculum can lead to more meaningful and impactful learning experiences for learners (Demssie et al., 2020; Zidny et al., 2020; Zidny & Eilks, 2020). In addition, studies have highlighted the positive effects of community involvement in education, emphasising the role of community elders and knowledgeable individuals in preserving and transmitting cultural knowledge to younger generations (Asim & Riaz, 2020; Lema & Mwila, 2022; Watson et al., 2017). Therefore, the learners' call for community involvement aligns with the broader educational discourse on the importance of integrating Indigenous perspectives and community expertise to create a more inclusive and culturally responsive learning environment.

6.4.4 Theme 4: Emotional impact of loud sounds

The data from the learners' reflective journals (see Section 4.3.3.4 for more details) revealed that some learners expressed discomfort and pain caused by loud sounds, indicating the emotional effect of excessive noise levels on their learning environment and well-being. They acknowledged the importance of controlling the volume of the instruments to prevent discomfort and potential damage to their eardrums. For instance, MamNgqosini mentioned: *“Iindlebe zam bezibuhlungu sisandi esiphezulu segubu”* (My ears were painful from the loud sound of a drum). Mfene added: *“Khange ndisithande isandi segubu”* (I did not like the drum's sound). MamBathane also noted: *“Isandi segubu besiphezulu kakhulu”* (The sound of the drum was too loud for me).

The learners' responses underscore the profound effect of loud sounds on their emotional wellbeing during the learning process. The discomfort and pain expressed by MamNgqosini due to the loud sound of a drum as well as Mfene's aversion to the drum's sound, highlight the

adverse emotional effects of excessive noise levels. In addition, MamBathane's statement about the drum being too loud further emphasises the negative emotional impact of loud sounds on the learners' well-being. This shows that the person who was playing the drum was an amateur in that industry. This suggests that for a lesson to be smooth, we need to invite a knowledgeable person to come and play the drum for us.

These insights align with previous literature emphasising the detrimental emotional effects of loud sounds on individuals, particularly in educational settings. Research has shown that exposure to high levels of environmental noise, such as loud sounds in classrooms or educational environments, can lead to increased stress, irritability and decreased emotional well-being among learners (Jafari et al., 2019; Makebo, 2019; Shield, 2023; Tomek, 2022). Furthermore, studies have highlighted the importance of creating quieter, more conducive learning environments to mitigate the emotional impact of excessive noise on learners' overall well-being and academic performance (Block, 2018; Domeier & Wiebe, 2020; Fang et al., 2023; Mealings, 2023).

6.5 Comparative Analysis

In this section, I present a comparative analysis of the data gathered from lesson observations, focus group interviews (sharing circles) and learners' journal reflections. By examining the findings from these varied data collection methods, this aims to identify recurring themes and divergent perspectives. By providing a comprehensive understanding of the mediating learning of sound through cultural music and dance stories to Grade 4 farm school learners. Table 4 below illustrates the synthesis of findings across these data sources, clarifying the common threads and distinct viewpoints that have emerged from the comprehensive data analysis.

Table 6.5: Integration of findings

Theme	Source
Community Engagement and Involvement	- Focus group interviews - Learners' reflexive journals
Integration of Indigenous Knowledge in Modern Science	- Lesson observation - Focus group interviews - Learners' reflexive journals
Experiential learning through practical, hands-on activities	- Lesson observation
Cultural Sound and Instrument Knowledge	- Learners' reflective journals
Emotional Impact of Loud Sounds	- Learners' reflective journals

The table provides a succinct overview of the themes identified in the data sources, showcasing the comprehensive exploration of the educational experience. The presence of community engagement and involvement as a recurring theme across focus group interviews and learners' reflective journals demonstrates the interconnectedness of community participation in the learning process. Similarly, the integration of IK with modern science emerged as a consistent theme across the different data sources, highlighting the significance of integrating traditional wisdom into contemporary educational practices.

The theme of experiential learning through practical/hands-on activities observed through lesson observations reflects the significance of hands-on, practical activities to promote learners' active participation, enhancing their understanding of sound production and fostering a sense of excitement. In addition, the emphasis on cultural sound and instrument knowledge, primarily evident in the learners' reflective journals, underscores the learners' engagement with and appreciation for their cultural heritage.

Furthermore, the emotional impact of loud sounds, as revealed in the learners' reflective journals, emphasises the importance of considering the affective dimensions of the learning environment. Overall, the table effectively encapsulates the diverse thematic insights derived from the varied data sources, offering a holistic view of the mediating learning of sound through cultural music and dance *stories* to Grade 4 farm school learners.

6.6 Chapter Summary

Chapter Six aimed at analysing and interpreting the data obtained from lesson observations, focus group interviews (sharing circles) and learners' reflective journals. The main objective of the chapter was to answer the following research questions:

3a. What enables Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?

3b. What constrains Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?

The thematic analysis of the data revealed five key themes as presented in the comparative analysis, namely:

- 1) Community engagement and involvement
- 2) Integration of IK into modern science
- 3) Experiential learning through practical/hands-on activities
- 4) Cultural sound and instrument knowledge
- 5) Emotional impact of loud sounds

These themes provided valuable insights into the factors that facilitate or hinder learners' engagement with the topic of sound. The research question was effectively answered based on the key themes. Community engagement and involvement emerged as a crucial facilitation process, highlighting the importance of incorporating community perspectives and expertise in the learning process. The integration of IK with modern science underscored the significance of blending traditional wisdom with contemporary educational practices to enhance learners' understanding (Seehawer & Breidlid, 2021). Furthermore, the emphasis on cultural sound and

instrument knowledge showcased the learners' engagement with their cultural heritage, while the acknowledgement of the emotional impact of loud sounds emphasised the need to consider the affective dimensions of the learning environment. The next chapter presents a detailed account of the discussion of the main findings of the study, providing a comprehensive analysis and interpretation of the thematic insights derived from the data and their implications for educational practice and future research.

CHAPTER SEVEN: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

7.1 Introduction

This chapter synthesises the insights and findings gathered from the exploration of IK integration into the Grade 4 Natural Sciences and Technology curriculum at a South African farm school. The investigation sought to understand the effect of culturally relevant pedagogy on the teaching and learning of scientific concepts, with a specific focus on the unit of sound. Acknowledging the vital intersection or connection between IK and Western science, the research uncovered the nuances of learner engagement, the role of language in scientific understanding and the implications for curriculum policy and practice. This concluding chapter aims to draw together the central threads of the study, reflect on the broader implications of IK integration for science education, and chart a path forward for curricular innovation and educational inclusivity.

7.2 Summary of the Findings

In this section, I present and discuss the main findings of the study in accordance with my research questions. As alluded to in the introduction, the synthesis of these findings aims to shed light on the factors that enable or constrain the learning of Grade 4 Natural Sciences and Technology learners from a farm school on the topic of sound.

7.2.1 Research questions 1

What *stories* about cultural beliefs and practices in traditional music and dance do Grade 4 Natural Sciences and Technology learners from a farm school know from their homes and community?

In answering the question regarding what stories and cultural beliefs about traditional music and dance Grade 4 Natural Sciences and Technology learners from a farm school bring from their homes and community, the study unearthed a rich tapestry of narratives that form the backdrop of the learners' everyday lives. The findings indicate that learners carry with them an

extensive repository of cultural practices and shared knowledge, profoundly imbued with the local music and dance of their communities.

The stories that surfaced revolved primarily around community events and family gatherings where music and dance play a central role in expression and celebration. Learners recounted festivities marked by the rhythms of drums, the sounds of traditional stringed instruments, and the melody of folk songs passed down across generations. Dance movements, often symbolising deeper cultural significance or telling ancestral stories, were highlighted in the learners' narratives as integral to these musical expressions.

Such stories from home and community reflect a deep connection with the land, the people, and their collective history, embodying the living culture of their community. The learners brought to light tales of ritual dances conducted during certain seasons, songs sung during rites of passage, and instrumental sounds associated with specific cultural rites. These cultural activities provide not only a sense of identity and belonging but also serve as a medium for the transmission of knowledge and values. The importance and prevalence of storytelling in indigenous communities are noted by scholars like Iseke (2013) and Tzou et al. (2019).

The learners shared that such cultural music and dance were more than artistic expressions: they had accompanying narratives that often carried lessons, moral codes and the collective wisdom of their people. As narrated by the learners, these stories provided an oral curriculum that educated them on how to be, to know and to relate both within their culture and the natural world. This resonates with the seminal work of Seehawer (2018) who reinforces the view that indigenous modes of knowledge transmission serve as critical educational frameworks.

7.2.2. Research question 2

How do the presentations by the Indigenous Knowledge Custodians on stories about the cultural beliefs and practices of traditional music and dance and consolidation thereof enable or constrain the engagement of Grade 4 Natural Sciences and Technology learners from a farm school on the topic of sound?

The presentations by the IKCs from the same family concerning cultural beliefs and practices related to traditional music and dance provided significant insights into how these engagements enabled and sometimes constrained learners' ability to discuss and conceptualise the topic of sound.

7.2.2.1. Enabling understanding through cultural expertise

The contribution of IKCs in this study facilitated a marked enhancement in learners' understanding of sound. By sharing their stories and demonstrating traditional music and dance, IKCs offered an authentic context for sound as a scientific phenomenon. Learners witnessed firsthand how various instruments were made and played, leading to a tangible understanding of concepts such as vibration, pitch and resonance. This experiential learning aligns with the literature, such as Liveve (2017) emphasises the connection between sensory experiences and cognitive development.

Through the lens of Vygotsky's sociocultural theory, the IKCs' presentations acted as a bridge between familiar cultural knowledge and new academic insights into the principles of sound. As the learners were encouraged to question and discuss these presentations, it became clear that IKCs played a vital role in scaffolding the learners' cognitive processes through social interaction and shared cultural reference points.

These narrative sessions also provided a platform for active engagement, reflection, and dialogue, critical factors for sense making in science education highlighted by scholars such as Lemke (2001) and Gwekwerere (2016). Engaging with cultural music and dance alongside the IKCs, the learners could articulate their understandings and form associative links between their cultural contexts and the scientific content of their lessons.

7.2.2.2 Constraints in integrating cultural expertise

Despite the clear benefits, some constraints were encountered in the integration of IK into the curriculum. The findings indicated that learners sometimes faced challenges in reconciling IK with the structured learning of conventional science. The transition from cultural narratives and practices to scientific abstraction required learners to re-assess their pre-existing knowledge, which could lead to cognitive dissonance or confusion (Le Grange, 2007), touching on issues raised by Hodson (2009) regarding the potential challenge of accommodating traditional knowledge within scientific frameworks.

Furthermore, cultural presentations might inadvertently lead to a romanticised or exoticised view of indigenous practices if not carefully contextualised within the scientific curriculum. In this regard, science teachers have to ensure that while IK was respected for its cultural value, it was also critically engaged in terms of its scientific insights, as emphasised in the cautionary literature by Horsthemke and Schafer (2007).

7.2.3 Research question 3 (a and b)

- What enables Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?
- What constrains Grade 4 Natural Sciences and Technology learners to talk about and make sense of the topic of sound?

To address these research questions, the study employed various instruments to collect data, including focus group interviews (sharing circles) with the learners, learners' journal reflections, and lesson observations. The thematic analysis revealed the following factors that can significantly influence the ability of Grade 4 NS-Tech learners from a farm school to comprehend and engage with the topic of sound.

7.2.3.1 The integration of Indigenous knowledge into science education

The study revealed that the integration of culturally relevant materials and activities into the science curriculum significantly enhanced learners' comprehension and engagement with the topic of sound. The integration of IK related to sound, such as traditional music, instruments and dance, made the learning experience more relatable and engaging for them. This finding aligns with scholarly perspectives by Liveve (2017) and Idamoyibo (2016), who emphasise the importance of cultural relevance and contextualisation in scientific education. The integration of IK in science has also been shown to contribute to sustainable development by acknowledging the potential of the local environment and the wisdom of indigenous populations (Romualdo et al., 2022). Bernardi and Santos (2021) also report that the integration of IK into science has positive effects on learners, such as increasing their self-esteem and providing a greater appreciation of traditional culture.

Moreover, bilingual teaching strategies were found to be invaluable for enhancing learners' comprehension of scientific topics, especially for those whose first language is not English. The practice of initially engaging with scientific concepts in the learners' mother tongue before transitioning to English deepened conceptual understanding and accessibility, resonating with

the advocacy of scholars such as Nemutanzhela and Makonye (2010) regarding the cognitive benefits of bilingual strategies.

However, the study also highlighted factors which constrained learners' engagement with the topic of sound. The learners' proficiency in English was identified as a substantial obstacle, particularly for those whose first language is not English. This resonated with one of TIMSS's findings on how language proficiency affects learners' performance in science-related subjects. Pedagogical challenges in transitioning from concrete IK patterns to abstract scientific explanations and resource limitations in the farm school environment were also identified as constraints to learner engagement with the topic of sound. The need for the pedagogical ability to navigate learners' transition from one knowledge system to another was emphasised, in line with Hodson's observations (2009). Furthermore, resource limitations in the form of inadequate equipment and materials were noted as barriers to providing practical, hands-on experiences that support learning, aligning with Dolmans' (2016) emphasis on the importance of a well-equipped learning environment for practical demonstrations and discovery-based learning.

7.2.3.2 Experiential learning through hands-on activities

Active participation through hands-on activities and cultural storytelling sessions emerged as distinct enablers of learners' comprehension of sound. The study found that when learners engaged in practical activities, such as creating and experimenting with traditional instruments, they were able to experience the physical principles of sound, leading to a deeper understanding of the subject matter. Furthermore, the integration of cultural storytelling sessions provided a contextualised approach to learning about sound, allowing learners to connect with the topic on a more personal and meaningful level. This coheres with the educational perspective advocated by Aikenhead and Jegede (1999), which emphasises the integration of culture in science teaching as a means of enhancing relevance and understandability. Similarly, research by Sumarmi et al. (2020) demonstrates that experiential learning models enhanced learners' learning scores and ability to manage disaster education. Furthermore, a case study by Voukelatou (2019) demonstrates the significant impact of experiential learning on acquiring knowledge and developing social skills, contributing to the promotion of cultural heritage and traditional values. Lê and Tran (2023) also found that experiential learning in the context of teaching the Vietnamese language in primary schools effectively encouraged learners to analyse and apply knowledge to real-world situations.

The study's findings also echoed the broader consensus within educational research literature regarding the effect of interactive, practical learning experiences in driving the internalisation of scientific concepts, ultimately contributing to improved comprehension and retention of knowledge. Moreover, the active participation of learners in hands-on activities not only facilitated a more engaging learning experience but also encouraged a deeper level of involvement and understanding. The tangible experiences gained through these activities fostered a more profound and memorable learning experience, allowing learners to internalise abstract concepts through direct engagement. This finding resonates with the scholarly perspective on the cognitive benefits of experiential learning as highlighted by Smith et al. (2019), emphasising the importance of hands-on activities in enhancing learners' learning outcomes and promoting a deeper understanding of complex concepts. In this way the integration of experiential learning through practical activities not only catered to diverse learning styles but also contributed to the creation of a more conducive learning environment. This aligns with contemporary educational principles that advocate learner-centred, active learning approaches to enhance the learning experience and promote meaningful understanding.

7.2.3.3 Community involvement in knowledge acquisition

The study revealed another significant contributor to learners' comprehension of sound, namely, the perceived relevance of knowledge from their home and community environments when learning about specific topics. This emphasised the learners' recognition of the value of information obtained through community observation and from their parents, underscoring the instrumental role of local knowledge in shaping their understanding of the subject. This observation not only demonstrated the learners' acute awareness of the practical application of sound-related concepts in their immediate surroundings but also highlighted the tangible effect of community involvement on their educational experiences (Demssie et al., 2020; Lema & Mwila, 2022; Watson et al., 2017). It further exemplified the learners' holistic understanding of the harmonious relationship between their lived experiences and science lessons. It emphasised the intrinsic value of integrating local knowledge and community involvement into the science lesson. These findings are consistent with prior research that emphasises the significance of integrating learners' lived experiences and community knowledge into the academic curriculum to promote meaningful learning experiences and foster a deeper

understanding of scientific principles (Baharin et al., 2019; Nortvig et al., 2018; Ryu et al., 2019).

The learners' recognition of the practical application of sound-related concepts in their immediate surroundings underscores the real-world relevance of their academic studies, thereby enhancing their motivation and engagement with the subject matter. Additionally, the palpable influence of community involvement on the learners' educational experiences emphasised the need for educational institutions to recognise and integrate local knowledge into science lessons. This integration not only enriches the learning experience but also fosters a deeper understanding of scientific concepts by contextualising them within the learners' everyday experiences.

7.2.3.4 Emotional impact of loud sounds

On the other hand, a significant constraint that emerged was the adverse emotional effect of loud sounds on the learners. The learners expressed discomfort and pain caused by loud sounds, signalling the emotional toll of excessive noise levels on their learning environment and overall well-being. Their acknowledgement of the importance of controlling the volume of instruments to prevent discomfort and potential damage to their eardrums indicated a palpable concern about the negative effects of loud sounds. Notably, MamNgqosini's expressed discomfort and pain due to the loud sound of a drum and Mfene's aversion to the drum's sound was also noted, underscoring the adverse emotional effect of excessive noise levels. Additionally, MamBathane's statement about the drum being too loud further emphasised the negative emotional effect of loud sounds on the learners' well-being.

These findings are in line with previous literature that underscores the detrimental emotional effects of loud sounds, particularly in educational settings. Research has demonstrated that exposure to high levels of environmental noise, such as loud sounds in classroom environments, can lead to heightened stress, irritability, and decreased emotional well-being among learners (Jafari et al., 2019; Makebo, 2019; Shield, 2023; Tomek, 2022). Furthermore, studies have pointed out the significance of creating quieter environments, more conducive to learning, to mitigate the emotional impact of excessive noise on learners' overall well-being and academic performance (Block, 2018; Domeier & Wiebe, 2020; Fang et al., 2023; Mealings, 2023). These insights underscore the importance of addressing the emotional consequences of

loud sounds in educational settings to foster a supportive environment conducive to learning for the learners

7.4 New Knowledge

The study on the integration of IK and experiential learning in science has uncovered valuable insights. The integration of culturally relevant materials and activities within the science curriculum was found to enhance learners' comprehension and engagement with scientific concepts significantly, particularly in the context of sound. Active participation in hands-on activities and cultural storytelling sessions also emerged as a key factor in facilitating a deeper understanding of the physical principles of sound.

In the Xhosa culture learners are not allowed to question their elders and that is regarded as disrespectful. However, this study challenged such stereotypes by allowing them to freely ask questions. Moreover, the presentations by the IKCs provided important insights into how these engagements enable learners' ability to discuss and conceptualise the topic of sound highlighting the significance of integrating local knowledge and community involvement into the academic curriculum for meaningful learning experiences and a deeper understanding of scientific principles.

7.5 Limitations

The study, while illuminating the value of integrating IK into science education, acknowledges several limitations:

1. **Scope of Cultural Contexts:** The study focused mainly on a single cultural context, limiting the universality of its findings across South Africa's diverse cultural landscape.
2. **Sample Size and Diversity:** Research was conducted in a single farm school, with a relatively small sample size that may not fully represent the broader population of Grade 4 learners.
3. **Language Proficiency Variability:** The study did not account for the varying levels of English proficiency among learners, which could

influence their ability to engage with and understand scientific terminology.

4. **Depth of IK Engagement:** Constraints on time and resources meant that the depth of engagement with IK narratives might have been less than optimal, affecting the study's effect on learners.
5. **Long-Term Retention:** The study was limited to short-term observations; it did not assess the long-term retention and effect of IK integration on learners' scientific understanding.
6. **Quantitative Measures:** A predominantly qualitative approach was taken, with limited quantitative data, to reinforce the findings on learner performance and comprehension.

Each of these limitations suggests areas for further research to deepen our understanding of IK's role in enhancing science education.

7.6 Recommendations for Future Research

Given the valuable insights gleaned from the study, I propose the following recommendations to enhance the teaching and learning of sound-related concepts:

1. **Expansion of Cultural Contexts:** Future studies should extend to multiple cultural contexts to explore how different forms of IK can be integrated within varied cultural settings, ensuring a more inclusive science curriculum that reflects South Africa's diverse heritage.
2. **Broader Sampling:** It is recommended that the research be conducted across a wider range of schools, including urban, peri-urban and rural settings, with a larger and more diverse sample of learners to enhance the generalisability of the findings.
3. **Diverse Linguistic Proficiency Assessment:** Considering the linguistic diversity of South Africa, future research should stratify samples based on learners' linguistic proficiencies, to better understand how language barriers affect the integration of IK in science learning.

4. **Deepening IK Engagement:** To assess the effect of IK on scientific comprehension, it is recommended that curricula provide more extensive and continuous engagement with IK narratives, possibly as part of long-term project-based learning.
5. **Longitudinal Studies:** Conducting longitudinal studies that track learner performance and retention over extended periods would provide insight into the lasting educational impact of IK integration.
6. **Inclusion of Quantitative Measures:** Incorporating quantitative metrics, such as assessment scores or standardised tests alongside qualitative observations would offer a more comprehensive analysis of the effectiveness of IK inclusion in science education.
7. **Teacher Training Enhancement:** To better equip educators for the complexities of teaching science with IK integration, targeted professional development programmes should be constructed, focusing on cultural sensitivity, bilingual pedagogies, and the use of IK as an educational resource.
8. **Community Engagement Programmes:** Schools should establish formal community engagement programmes that facilitate regular interactions between learners, teachers, and IK custodians, promoting a continuous exchange of knowledge and cultural values.
9. **Curriculum Development Collaboration:** Policymakers, educators and community members should collaborate in a participatory approach to curriculum development that foregrounds the value of IK alongside scientific principles, creating a more contextually relevant syllabus.
10. **Assessment Reforms:** Teachers should consider revising learner assessment methods to account for and value the knowledge and cognitive skills derived from IK narratives and cultural experiences, thereby aligning evaluation with an inclusive pedagogical approach.

These recommendations aim to strengthen the integration of IK into science education, which could transform learning environments to become more culturally conscious and responsive to the needs of all learners, thereby promoting a more holistic and equitable educational experience.

7.7 My Reflections

I first came to Rhodes University in 2017, to do a BEd. in Science Education. The Sarah Baartman District offered me this opportunity and I was grateful. My first year at Rhodes University was a horrible nightmare in that the treatment was not good. For instance, in one of the accommodations they locked us out the whole night while we were busy in the computer lab. The lecturers did not care, and they treated us like children the way they addressed us. That year was the most difficult and I even regretted accepting the offer to study at Rhodes University. But with God's help, I proceeded to the following year as some of my colleagues were excluded by the university due to academic performance.

Then in 2018 Professor Ngcoza and Dr Mutanho were introduced to us as our lecturers. Since I had already lost interest in the course, when they were introduced to us, I had a negative attitude. The energy was not the same and I was demotivated. To my surprise, the treatment was totally different. They treated us with humanity, respect and dignity and addressed us very well. They talked some sense into us telling us not to give up. Dr Zuki Nhase also came and motivated us to not give up. Our mindset became positive. Dr Mutanho would sing a song for us saying "*Ndibamba ngesandla ndingawi emlilweni*" (Hold my hand so that I do not fall in fire) which helped a lot. As a result, the environment changed, and from then I enjoyed studying at Rhodes.

The same year we met them, they introduced us to IK which was a new concept for me. I was surprised when Dr Mutanho showed us that the CAPS document had information about IK because I had never noticed it. Hence, I recommend that teachers should be well-trained in how to use this document. I never thought I would integrate IK into my lessons and that learners would enjoy it. The same year I participated in Dr Mutanho's study. He invited MamNgwevu (clan name) to demonstrate how to make *umqombothi* in our class. MamNgwevu explained in detail the process of making *umqombothi*. In the whole process science concepts were pointed out to us, which is something I had never thought of. I was also amazed by the involvement of a community member. The study revealed the importance of Indigenous customs that I had

unwittingly overlooked in my science teachings. The presentation by Indigenous Knowledge Custodians was a perfect example, as it provided insight into how *uhadi* is played. The participation by the Indigenous Knowledge Custodians in the project made me realize the importance of their knowledge and how it may be effectively integrated into science lessons. As a result, this exposure and direct involvement had a tremendous impact on my academic and professional development as a researcher and teacher.

In 2019, the lecturing staff visited my school where we talked about my school being a pilot school for learning science in isiXhosa. Professor Ngcoza said that this could be my master's research. He further said you should not consider yourself a dropout because if you did not continue with your studies then you would be a dropout. Their motivation encouraged me to further my studies and develop a love for IK. 2020 started smoothly but Covid-19 happened, and we only had one session where we met as students. However, that did not stop us from continuing with our studies and different strategies were used.

In 2022, I applied for my master's and from the outset, I had a problem with registration. Vaccinating for Covid-19 was against my beliefs, so I did not have a vaccination certificate. With the help of my supervisor and the Dean of the Department of Education, I registered but I was not allowed to attend contact sessions. Other than that, 2022 was not that challenging. Then the 2023 academic year brought back 2017's experiences. From March to September, I had to resubmit my research proposal which demotivated me considerably. It was a struggle for me, and because of this, I consider myself as someone who has low self-esteem. I was ready to give up but my colleagues and my supervisor whom the spirit of Ubuntu runs through motivated me not to give up. That is when I realised that I was not a failure. I am grateful for the opportunity I received from Rhodes University to attend SAARMSTE Conferences in Bloemfontein and Namibia. As I mentioned earlier, I had a problem with self-esteem but attending and presenting at that level made me overcome my fears. I am now still working on my presentation skills. Being a farm schoolteacher is not easy as people normally looked down on us, but doing this study made the impossible possible. I have a problem to stand in the crown and present but now I can broadly address teachers without fear. I can say that it is true when they say "Every cloud has a silver lining" I can attest to that.

As challenging as it was, the concept of Ubuntu introduced by my supervisors and family members kept me going. They made the impossible possible. I learned a lot from this family,

such as calling my learners by their clan names and encouraging them to call me by my clan's name creating a strong bond. As a result, we respected and understood each other. That is the value of Ubuntu. Appreciation goes to my supervisor Mthembu (clan name) who helped me with my IKCs and was there when I visited them. This showed the power and spirit of *Ubuntu* running in his veins.

In addition, I thank God for my helpful and inspiring supervisors, Prof. Ngcoza and Mr Mapfumo, as well as great colleagues in my community of practice (CoP), my critical friend, and Dr Mutanho. Your constant support, inspiration, and continuous sharing of valuable resources and expertise to foster our personal and professional development made it possible for me to complete this study. To my darling angels (my learners), your hard work, dedication to my study, and eagerness to learn when we visited the IKCs are greatly appreciated. They learned to take notes, writing their journal reflections with enthusiasm. They were confident to ask questions in a respectful manner and I applaud them for that.

The findings of this study have prompted me to reflect on the profound effect of culturally relevant and experiential learning in science education. The recognition of IK and the integration of hands-on activities have not only enhanced my understanding of scientific concepts but have also fostered a deeper connection with the subject matter. The awareness of the emotional impact of loud sounds on learners has also highlighted the importance of creating a supportive environment conducive to learning. These insights have reinforced my belief in the value of embracing diverse perspectives and experiences in education and have inspired me to advocate inclusive and culturally responsive approaches to learning.

7.8 Conclusion

The conclusion of the study on integrating IK into the Grade 4 NS-Tech curriculum at a South African farm school offers significant insights into the intersection of cultural relevance and scientific education. Central to this study was the recognition that when science education integrates elements of learners' sociocultural backgrounds (Mavuru & Ramnarain, 2020), especially using traditional music, dance and narratives related to the subject of sound, the learning experience becomes more authentic, meaningful and engaging. This approach aligns with broader educational theories that advocate the importance of contextualising learning within learners' lived experiences and cultural understandings. The study demonstrates how the integration of IK not only aids in making scientific concepts relatable but also enhances

learners' comprehension, particularly when bilingual teaching strategies are employed. This is particularly relevant in contexts where English is not the first language of the learners, highlighting the role of language as a crucial tool in educational accessibility and understanding. The study also demonstrates the value of experiential learning in reinforcing scientific understanding.

However, the study also brings to light several challenges in the integration of IK into science lessons. One significant constraint is the language barrier, as proficiency in English, the medium of instruction, greatly influences learners' ability to grasp and articulate scientific concepts. Another challenge is the pedagogical shift required to transition from the concrete, experiential learning common in IK to the more abstract theoretical explanations of science. This necessitates a careful balancing act by teachers to merge these diverse knowledge systems without causing cognitive dissonance among learners. Resource limitations within the farm school setting also posed practical challenges to providing hands-on, experiential learning opportunities, which are vital for reinforcing scientific understanding.

References

- Adu, K. O., Mpu, Y., & Adu, E. O. (2020). Virtual Learning: A panacea for effective teaching and learning during and after COVID-19 pandemic. *KIU Journal of Education*, 15(1), 165-187.
- Aikenhead, G. S., & Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, 36, 269-287.
- Alexiades, A. V., Haeffner, M. A., Reano, D., Janis, M., Black, J., Sonoda, K., Howard, M., Fiander, C., & Buck, M. (2021). Traditional ecological knowledge and inclusive pedagogy increase retention and success outcomes of STEM students. *The Bulletin of the Ecological Society of America*, 102(4), e01924.
- Anthony-Stevens, V., Mahfouz, J., & Bisbee, Y. (2020). Indigenous teacher education is nation building: Reflections of capacity strengthening in Idaho. *Journal of School Leadership*, 30(6), 541-564.
- Asheela, E. N. (2017). *An intervention on how using easily accessible resources to carry out hands-on practical activities in science influences science teachers' conceptual development and dispositions* [Unpublished master's thesis]. Rhodes University.
- Asheela, E., Ngcoza, K. M., & Sewry, J. (2021). The use of easily accessible resources during hands-on practical activities in rural under-resourced Namibian schools. In U. Ramnarain (Ed.), *School science practical work in Africa: Experiences and challenges* (pp. 15-31). Routledge Taylor & Francis Group.
- Asim, S., & Riaz, A. (2020). *Community engagement in schools: Evidence from a field experiment in Pakistan*. The World Bank.
- Baharin, N., Kamarudin, N., & Manaf, U. K. A. (2018). Integrating STEM education approach in enhancing higher order thinking skills. *International Journal of Academic Research in Business and Social Sciences*, 8(7), 810-821.
- Banu, S. (2011). *The role of practical work in teaching and learning at secondary level in Bangladesh* [Unpublished master's thesis]. University of Canterbury.

- Battiste, M. (2005). Indigenous knowledge: Foundations for first nations. *WINHEC: International Journal of Indigenous Education Scholarship, 1*, 1-17.
- Bautista, M.Á., Guo, P., Abnar, S., Talbott, W.A., Toshev, A., Chen, Z., Dinh, L., Zhai, S., Goh, H., Ulbricht, D., Dehghan, A., & Susskind, J.M. (2022). GAUDI: A neural architect for immersive 3D scene generation. *Advances in Neural Information Processing Systems, 35*, 25102-25116.
- Bernardi, L. T. M., & Santos, J. A. (2021). Math education in intercultural contexts: A logical-mathematical interpretation for duality Kaingang Kamé-Kairu. *Ciência & Educação (Bauru), 27*. <https://doi.org/10.1590/1516-731320210011>.
- Bertram, C., & Christiansen, I. (2015). *Understanding research: An introduction to reading research*. Van Schaik.
- Bertram, C., & Christiansen, I. (2020). *Understanding research: An introduction to reading research* (3rd ed.). Van Schaik.
- Block, S. M. (2018). Classroom design and its influence on students' performance within the autism spectrum diagnosis.
- Bottiani, J. H., Larson, K. E., Debnam, K. J., Bischoff, C. M., & Bradshaw, C. P. (2018). Promoting educators' use of culturally responsive practices: A systematic review of inservice interventions. *Journal of Teacher Education, 69*(4), 367-385.
- Broodryk, J. (2006). The philosophy of ubuntu: Some management guidelines. *Management Today, 22*(7), 52-55.
- Bruner, J. (1990). Culture and human development: A new look. *Human Development, 33*(6), 344-355.
- Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? Research case examples. *Journal of Research in Nursing: JRN, 25*(8), 652-661. <https://doi.org/10.1177/1744987120927206>

- Cimi, P. V. (2009). *An investigation of the benefits of enhancing learners' conceptual development on nutrition utilizing wild food plants (iMifino)* [Unpublished master's thesis]. Rhodes University.
- Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. *Vygotsky's Educational Theory in Cultural Context*, 1(2), 39-64.
- Chikamori, K., Tanimura, C., & Ueno, M. (2019). Transformational model of education for sustainable development (TMESD) as a learning process of socialisation. *Journal of Critical Realism*, 5-18.
- Chilisa, B. (2012) *Indigenous research methodologies*. Sage Publications.
- Cocks, M. L., Alexander, J., & Dold, T. (2012). Inkubeko Nendalo: A bio-cultural diversity schools education project in South Africa and its implications for inclusive indigenous knowledge systems (IKS) sustainability. *Journal of Education for Sustainable Development*, 6(2), 241-252
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). Routledge.
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.) Routledge.
- Cobern, W. W. (1998). Science and a social constructivist view of science education. In W. W. Cobern (Ed.), *Socio-cultural perspectives on science education: An international dialogue* (pp. 7-23). Kluwer Academic Publishers.
- Creswell, J. W. (Ed.) (2012). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Sage.
- Creswell, J. W. (2015). *A concise introduction to mixed methods research*. Sage Publications.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative and mixed methods approaches* (5th ed.). Sage.

- David, B., & Resnik, J. D. (2010). *What is research ethics and why is it important?*
<http://www.niehs.nih.gov/research/resources/bioethics/whatis.cfm>
- Demssie, Y. N., Biemans, H. J., Wesselink, R., & Mulder, M. (2020). Combining indigenous knowledge and modern education to foster sustainability competencies: Towards a set of learning design principles. *Sustainability*, *12*(17), 6823.
- Department of Basic Education. (2011). *National Curriculum Statement (NCS). Grades R-12: Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences*.
Government Printers.
- De Valenzuela, J. (2009). *Socio-cultural views on learning: The SAGE handbook of special education*. Sage.
- Diano Jr, F., Kilag, O. K., Malbas, M., Catacutan, A., Tiongzon, B., & Abendan, C. F. (2023). Towards global competence: Innovations in the Philippine curriculum for addressing international challenges. *Excellencia: International Multi-disciplinary Journal of Education*, *1*(4), 295-307.
- Diwu, C. T., & Ogunniyi, M. B. (2012). Dialogical argumentation instruction as a catalytic agent for the integration of school science with indigenous knowledge systems. *African Journal of Research in MST Education*, *16*(3), 333-347.
- Domeier, L., & Wiebe, C. (2020). *Beyond the fancy table: How does classroom learning space design affect student social and emotional well-being?* [Unpublished master's thesis]. University of British Columbia.
- Dunn, W. (2001). The sensations of everyday life: Empirical, theoretical, and pragmatic considerations. *The American Journal of Occupational Therapy*, *55*(6), 608-620.
- Falk, J. H., & Dierking, L. D. (2000). *Learning from museums: Visitor experiences and the making of meaning*. AltaMira Press.
- Fang, Y., Luo, X., & Lu, J. (2023). A review of research on the impact of the classroom physical environment on schoolchildren's health. *Journal of Building Engineering*, *65*, 105430.

- Frey, B. B. (2018). Document analysis. In *the sage encyclopedia of educational research, measurement, and evaluation*. Sage. <https://dx.doi.org/10.4135/9781506326139.n209>.
- Gadzirayi, Christopher, T, Mutandwa, E., Chihiya, J., & Chikosha, M. (2006). Indigenous knowledge systems in sustainable utilisation of wetlands in communal areas of Zimbabwe: Case of Hwedza district. *African Journal of Agricultural Research*, 1(4), 131-134.
- Govender, N. (2014). Re-envisioning pedagogy for African higher education: Students' status of science and IKS via argumentation discourses. *Alternation Special Edition*, 12, 358384.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of Qualitative Research*, 2(163-194), 105.
- Guion, L. A., Diehl, D. C., & McDonald, D. (2010). *Triangulation. Establishing the validity of qualitative studies*. University of Florida. <http://edis.ifas.ufl.edu/fy394>
- Gwekwerere, Y. (2016). Schooling and the African child: Bridging African epistemology and Eurocentric physical sciences. In G. Emeagwali and E. Shizha (Eds.), *African indigenous and sciences: Journeys into the past and present* (pp. 33-46). Sense Publications.
- Handayani, M. (2018). Developing thematic-integrative learning module with problem-based learning model for elementary school students. *Jurnal Prima Edukasia*, 6(2), 166-176.
- Herrera, S. G. (2022). *Biography-driven culturally responsive teaching: Honoring race, ethnicity, and personal history*. Teachers College Press.
- Hodson, D. (1990). A critical look at practical work in school science. *School Science Review*, 70(256), 33-40.
- Hodson, D. (2009). *Teaching and learning about science language, theories, methods, history, traditions and values*. Sense Publishers.
- Holmes, A. G. D. (2020). Researcher positionality—a consideration of its influence and place in qualitative research: A new researcher guide. *Shanlax International Journal of Education*, 8(4), 1-10.

- Horsthemke, K., & Schafer, M. (2007). Does 'African mathematics' facilitate access to mathematics? Towards an ongoing critical analysis of ethnomathematics in a South African context. *Pythagoras*, 65, 2-9.
- Idamoyibo, A. A. (2016). Indigenous music in a new role. *Nordic Journal of African Studies*, 25(3&4), 329-348.
- Iseke, J. (2013). Indigenous storytelling as research. *International Review of Qualitative Research*, 6(4), 559-577.
- Iseke, J., & Brennus, B. M. J. K. (2011). Chapter sixteen: Learning life lessons from indigenous storytelling with Tom McCallum. *Counterpoints*, 379, 245-261.
- Ismailov, M. (2021). Virtual exchanges in an inquiry-based learning environment: Effects on intra-cultural awareness and intercultural communicative competence. *Cogent Education*, 8(1), 1982601.
- Jafari, M. J., Khosrowabadi, R., Khodakarim, S., & Mohammadian, F. (2019). The effect of noise exposure on cognitive performance and brain activity patterns. *Open Access Macedonian Journal of Medical Sciences*, 7(17), 2924.
- Jin, Q. (2021). Supporting indigenous students in science and STEM education: A systematic review. *Education Sciences*, 11(9), 555. <https://doi.org/10.3390/educsci11090555>.
- John-Steiner, V., & Mahn, H. (2008). Sociocultural approaches to learning and development: A Vygotskian framework. *Educational Psychologist*, 34, 113-115.
- Kadis, J. (2015). *Acoustic: The study of sound waves*. www.educ/192a/lecture1_caustics.pdf
- Kaup, C. F., & Brooks, E. (2022). A cultural-historical perspective on how double stimulation triggers expansive learning: How teachers and social educators can use double stimulation to implement computational thinking in mathematics. *Designs for Learning*, 14(1), 151-164.
- Khupe, C. (2014). *Indigenous knowledge and school: Possibilities of integration* [Unpublished doctoral dissertation]. University of Witswatersrand.

- Kibirige, I., & Van Rooyen, H. (2006). Enriching science teaching through the inclusion of indigenous knowledge. In J. de Beers & H. Van Rooyen (Eds.), *Teaching science in the OBE classroom* (pp. 235-247). Macmillan.
- Klein, J. (2011). Indigenous knowledge and education-the case of the Nama people in Namibia. *Education as Change*, 15(1), 81-94.
- Kozulin, A. (2012). *Psychological tools: A sociocultural approach to education*. Harvard University Press.
- Kuhlane, Z. (2011). *An investigation into the benefits of integrating learners' prior everyday knowledge and experiences during teaching and learning of acids and bases in grade 7: A case study* [Unpublished master's thesis]. Rhodes University.
- Lavallee, L. (2009). Practical application of an indigenous research framework and two qualitative indigenous research methods: Sharing circles and anshnabe symbol based reflection. *International Journal of Qualitative Methods*, 21-37.
- Lê, J. K., & Schmid, T. (2022). The practice of innovating research methods. *Organizational Research Methods*, 25(2), 308-336.
- Le, L. T., & Tran, T. Q. (2023). Effectiveness of experiential learning in teaching Vietnamese language in primary schools: Perspectives of teachers and administrators. *International Journal of Education and Practice*, 11(1), 85-93.
<https://doi.org/10.18488/61.v11i1.3263>.
- Le Grange, L. (2007). Integrating western and indigenous knowledge systems: The basis for effective science education in South Africa. *International Review of Education*, 53, 577-591.
- Le Grange, L. (2008). Challenges for enacting an indigenised science curriculum: A reply to Ogunniyi and Ogawa. *South African Journal of Higher Education*, 22(4), 817-826.
- Lema, P. R., & Mwila, P. M. (2022). Community involvement in school activities: Its effectiveness in promoting quality of learning in public secondary schools in Hai District, Kilimanjaro, Tanzania. *International Journal of Research and Innovation in Social Science (IJRISS)*, 6(9), 2454-6186.

- Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Ablex Publishing Corporation.
- Lemke, J. L. (2001). Articulating communities: Sociocultural perspectives on science education. *Journal of Research in Science Teaching*, 38(3), 296-316.
- Liamputtong, P. (2020). *Qualitative research methods*. Sage.
- Liveve, A. K. (2017). *Exploring the possibility of integrating traditional music and dance into the design and delivery of lessons on the concepts of echo and waves in the grade 10 Physical Science sound topic* [Unpublished master's thesis]. Rhodes University.
- Liveve, A. K. (2022). *Revitalisation and indigenisation of the science curriculum through drum making, drumming, music and dance* [Unpublished Doctoral thesis]. Rhodes University.
- Makabela, Q. N. (2015). Ubuntu as a foundation for researching African Indigenous Psychology. *Indilinga: African Journal of Indigenous Knowledge Systems*, 4(2), 284-291.
- Makebo, C.M. (2019). *Effect of noise pollution on teaching-learning process in secondary and preparatory schools of Sodo Town, Wolaita Zone, Southern Ethiopia* [Unpublished doctoral dissertation]. Haramaya University.
- Mapara, J. (2009). Indigenous knowledge systems in Zimbabwe: Juxtaposing postcolonial theory. *The Journal of Pan African Studies*, 3(1), 139-155.
- Maree, J. G. (2014). A guided meta-reflection theory of career counselling: A case study. *South African Journal of Higher Education*, 26, 670–690.
- Maree, J. G. (2015). Research on life design in (South) Africa: A qualitative analysis. *South African Journal of Psychology*, 45(3), 332-348.
- Martin, B. E., & Brouwer, W. (1991). The sharing of personal science and the narrative element in science education. *Science Education*, 75(6), 707-22.

- Masondo, G. (2013). The race connections in South African education. *Naptosa Insight*, 7(2), 14-16.
- Mateus, V., & Ngcoza, K.M. (2019). The making of clay pots and its relevance to school science: Reclaiming knowledge in the cultural practice of Ovambo people in Namibia. *Indilinga-African Journal of Indigenous Knowledge Systems*, 18(1), 64-77.
- Mavuru, L., & Ramnarain, U. (2017). Teachers' knowledge and views on the use of learners' socio-cultural background in teaching natural sciences in grade 9 township classes. *African Journal of Research in Mathematics, Science and Technology*, 21(2), 176-186.
- Mavuru, L., & Ramnarain, U. (2020). Learners' socio-cultural backgrounds and science teaching and learning: A case study of township schools in South Africa. *Cultural Studies of Science Education*, 1-29.
- Mayana, J. X. (2020). *Exploring affordances and hindrances when indigenous knowledge is integrated in the topic of waves and sound in a Grade 10 Physical Sciences township class* [Unpublished master's thesis]. Rhodes University.
- McEwan, B. (2020). Sampling and validity. *Annals of the International Communication Association*, 44(3), 235-247.
- McKoy, C. L., & Lind, V. R. (2022). *Culturally responsive teaching in music education: From understanding to application*. Taylor & Francis.
- Mealings, K. (2023). A scoping review of the effect of classroom acoustic conditions on university students' listening, learning, and well-being. *Journal of Speech, Language, and Hearing Research*, 66(11), 4653-4672.
- Mika, M. (2018). An analysis of possibilities for the establishment of a multipurpose and multidimensional cadastre in Poland. *Land Use Policy*, 77, 446-453.
- Millar, R. (2010). Practical work. In J. Dillon (ed.), *Good practices in science teaching: What research has to say* (2nd ed.) (pp. 108-134). Open University Press.
- Mills, G. E. (2011). *Action research: A guide for the teacher researcher* (4th ed.). Pearson Education.

- Mosimege, M. (2005). National priorities in indigenous knowledge systems: Implications for research and curriculum development. *Indilinga: African Journal of Indigenous Knowledge Systems*, 4(1), 31-37.
- Mosimege, M. D., & Onwu, G. (2004). Indigenous knowledge systems and science education. *Journal of the Southern African Association for Research in Mathematics, Science and Technology Education*, 8, 1-12.
- Mothwa, M. M. (2011). *Teachers' experiences of incorporating indigenous knowledge in the life sciences classroom* [Unpublished master's thesis]. University of Johannesburg.
- Morselli, C., Zaed, I., Tropeano, M. P., Cataletti, G., Iaccarino, C., Rossini, Z., & Servadei, F. (2019). Comparison between the different types of heterologous materials used in cranioplasty: A systematic review of the literature. *Journal of Neurosurgical Science*, 63(6), 723-736.
- Msimanga, A., & Lelliott, A. (2014). Talking science in multilingual contexts in South Africa: Possibilities and challenges for engagement in learners home languages in high school classrooms. *International Journal of Science Education*, 36(7), 1159-1183.
- Mukwambo, M., Ngcoza, K. M., & Chikunda, C. (2014). Africanisation, Ubuntu and IKS: A learner-centred approach. In C. Okeke, M. van Wyk & N. Phasha (Eds.), *Schooling, society and inclusive education: An Afrocentric perspective* (pp. 56-80). Oxford University Press.
- Murray, R. R. (2018). An overview of experiential learning in nursing education. *Advances in Social Sciences Research Journal*, 5(1). <https://doi.org/10.14738/assrj.51.4102>.
- Mushayikwa, E., & Ogunniyi, M. (2011). Modelling the integration of IKS into the teaching and learning of science. *19th Conference of the Southern Association of Research in Science, Mathematics and Technology Education* (pp. 408-425). North West University.
- Mutanho, C. (2021). *Exploring indigenisation of science curriculum through bottom-up decolonisation at a higher education institution in South Africa: affordances and hindrances* [Unpublished doctoral dissertation]. Rhodes University.

- Naidoo, N. (2007). *Indigenous knowledge in the national curriculum statement - from policy to practice for environmental education* [Unpublished master's thesis]. University of the Witwatersrand.
- Nakata, M., & Langton, M. (2009). *Australian indigenous knowledge and libraries*. University of Sydney Press.
- Nayak, J. K., & Singh, P. (2015) *Fundamentals of research methodology: Problems and prospects*. SSDN Publishers and Distributors.
- Ngai, P. B. Y., & Koehn, P. H. (2010). Indigenous studies and intercultural education: The impact of a place-based primary-school program. *Intercultural Education*, 21(6), 597-606.
- Nhase, Z. (2019). *An exploration of how grade 3 foundation phase teachers develop basic scientific process skills using an inquiry-based approach in their classrooms* [Unpublished doctoral dissertation]. Rhodes University.
- Nhase, Z. & Dube, B. (2023). Integrating storytelling and inquiry based approach as pedagogies of developing scientific skills in early childhood classrooms. *E-Journal of Humanities, Arts and Social Sciences*, 4(12), 32-42.
- Nikodemus, K. S. (2017). *Exploring how Grade 11 Physical Science learners make sense of the concept of rates of reactions through the inclusion of the indigenous practice of making Oshikundu* [Unpublished master's thesis]. Rhodes University.
- Nyika, R. (2017). Views and experiences of Gweru Rural Primary School teachers on integrating indigenous knowledge system in the teaching and learning of environmental science in Zimbabwe. *Scholars Journal of Art, Humanities and Social Sciences*, 5(4A), 280-286.
- Nortvig, A. M., Petersen, A. K., & Balle, S. H. (2018). A literature review of the factors influencing e-learning and blended learning in relation to learning outcome, student satisfaction and engagement. *Electronic Journal of E-learning*, 16(1), 46-55.

- Ogunniyi, M. B. (2006). Effects of a discursive course on two science teachers' perceptions of the nature of science. *African Journal of Research in Mathematics, Science and Technology Education*, 10(1), 93-102.
- Ogunniyi, M. B. (2007a). Teachers' stances and practical arguments regarding a science indigenous knowledge curriculum: Part 1. *International Journal of Science Education*, 29(10), 1189-1027.
- Ogunniyi, M. B., & Hewson, M. G. (2008). Effects of an argumentation-based course on teachers' disposition towards a science-indigenous knowledge curriculum. *International Journal of Environmental & Science Education*, 3(4), 159-177.
- Ogunniyi, M. B., & Ogawa, M. (2008). The prospects and challenges of training South African and Japanese educators to enact an indigenised science curriculum. *South African Journal of Higher Education*, 22(1), 175-190.
- Onwu, G.O.M., & Mufundirwa, C. (2020). A two-eyed seeing context-based approach for incorporating indigenous knowledge into school science teaching. *African Journal of Research in Mathematics, Science and Technology Education*, 24(2), 229-240.
- Özek, Y. H., Edgren, G., & Jandér, K. (2012). Implementing the critical friend method for peer feedback among teaching librarians in an academic setting. *Evidence Based Library and Information Practice*, 7(4), 68-81.
- Parmin, P., & Fibriana, F. (2020). The reconstruction of indigenous knowledge about globe (hornstedtia alliacea) as a natural resource conservation study for prospective teachers' scientific literacy. *Al-Ta lim Journal*, 27(2), 115-126.
- Rajagukguk, J., Simamora, P., Saragih, C. S., Abdullah, H., Gultom, N. S., & Imaduddin, A. (2020). Superparamagnetic behaviour and surface analysis of Fe₃O₄/PPY/CNT nanocomposites. *Journal of Nanomaterials*, 2020, 1-6.
- David, B., & Resnik, J. D. (2015). *What is ethics in research and why is it important?*
- National Institute of Environmental Health Sciences.
<http://www.niehs.nih.gov/research/resources/bioethics/whatis>

- Romualdo, A., Arroyo, J., Suriaga, E. G., & Fuentes, R. (2022). Traditional knowledge management (TKM) through biospecting: Mainstreaming scientific research trends and techniques for inclusive and sustainable education. *East Asian Journal of Multidisciplinary Research*, 1(7), 1497-1506. <https://doi.org/10.55927/eajmr.v1i7.837>.
- Roschelle, J. (1995). *Learning in interactive environments prior knowledge and new experiences*.
<http://www.exploratorium.edu/ifi/resources/museumeducation/priorknowledge.html>
- Ryu, M., Mentzer, N., & Knobloch, N. (2019). Preservice teachers' experiences of STEM integration: Challenges and implications for integrated STEM teacher preparation. *International Journal of Technology and Design Education*, 29, 493-512.
- Sannino, A. (2015). The principle of double stimulation: A path to volitional action. *Learning, Culture and Social Interaction*, 6, 1-15.
- Sannino, A., & Laitinen, A. (2015). Double stimulation in the waiting experiment: Testing a Vygotskian model of the emergence of volitional action. *Learning, Culture and Social Interaction*, 4, 4-18.
- Sedlacek, M., & Sedova, K. (2017). How many are talking? The role of collectivity in dialogic teaching. *International Journal of Educational Research*, 85, 99-108.
- Seehawer, M. (2018). South African teachers' strategies for integrating indigenous and western knowledges in their classes: Practical lessons in decolonisation. *Educational Research for Social Change*, 7(1), 91-110.
- Seehawer, M. (2018). Decolonising in sub-Saharan African context: Exploring Ubuntu as a foundation for research methodology, ethics and agenda. *International Journal of Social Research Methodology*, 21(4), 453-466.
- Seehawer, M. (2021). *Exploring how South African teachers can integrate students' indigenous knowledges in their regular teaching: Approaching bottom-up decolonisation through participatory action research* [Unpublished doctoral thesis]. Oslo Metropolitan University.

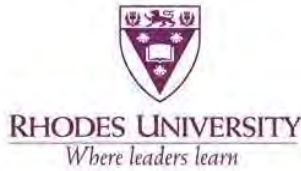
- Seehawer, M., & Breidlid, A. (2021). Dialogue between epistemologies as quality education: Integrating knowledges in sub-Saharan African classrooms to foster sustainability learning and contextually relevant education. *Social Sciences and Humanities Open*, 4, 1-8.
- Sedlacek, M., & Sedova, K. (2017). How many are talking? The role of collectivity in dialogic teaching. *International Journal of Educational Research*, 85, 99-108.
- Seehawer, M. (2023). Research agendas in an Ubuntu Paradigm. *Journal of Teaching and Learning in the South*, 7(1), 41-61.
- Scott, P. (2004). Teachers' talk and meaning making in science classroom: A Vygotskian analysis and review. In J. K. Gilbert (Ed.), *African Journal of Research in Mathematics, Science and Technology Education*, 74(96).
- Semali, L. M., & Kincheloe, J. L. (1999). *What is indigenous knowledge? Voices from the academy*. Falmer Press.
- Shield, B. (2023). A sound environment for schools: 60 years of research into the impact. *INTER-NOISE and NOISE-CON Congress and Conference Proceedings* (Vol. 265, No. 1, pp. 6693-6715). Institute of Noise Control Engineering.
- Shinana, E., Ngcoza, K. M., & Mavhunga, E. (2021). Development of teachers' PCK for a scientific inquiry-based approach in Namibia's rural schools. *African Journal of Research in Mathematics, Science and Technology Education*, 1-12.
- Shizha, E. (2007). Critical analysis of problems encountered in incorporating indigenous knowledge in science teaching by primary school teachers in Zimbabwe. *The Alberta Journal of Educational Research*, 53(3), 302-319.
- Sileyew, K. J. (2019). Research design and methodology. *Cyberspace*, 1-12.
- Smith, L. T. (2012). *Decolonizing methodologies: Research and indigenous peoples* (2nd ed.). Zed Books.

- Stott, D. (2016). Making sense of the ZPD: An organizing framework for mathematics education research. *African Journal of Research in Mathematics, Science and Technology Education*, 20(1), 25-34.
- Strijker, D., Bosworth, G., & Bouter, G. (2020). Research methods in rural studies: Qualitative, quantitative and mixed methods. *Journal of Rural Studies*, 78, 262-270.
- Sumarmi, S., Bachri, S., Irawan, L. Y., Putra, D. B. P., Risnani, R., & Aliman, M. (2020). The effect of experiential learning models on high school students learning scores and disaster countermeasures education abilities. *Journal for the Education of Gifted Young Scientists*, 8(1), 61-85. <https://doi.org/10.17478/jegys.635632>.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339.
- Tomek, R. (2022). *Quiet please! School noise and its effects on student teachers and practicing teachers*. Universität Passau.
- Tzou, C., Meixi., Suárez, E., Bell, P., LaBonte, D., Starks, E., & Bang, M. (2019). Storywork in STEM-Art: Making, materiality and robotics within everyday acts of indigenous presence and resurgence. *Cognition and Instruction*, 37(3), 306-326.
- United Nations Educational, Scientific and Cultural Organization. (1999). *Cultural challenges of the International Decade of the World's Indigenous People*, 18-20 October. UNESCO.
- Van Zyl, L. E., Custers, N., & Klibert, J. (2023). The holistic life-crafting model: A systematic literature review of meaning-making behaviors. *Frontiers in Psychology*, 14, 1271188.
- Venter, E. (2004). The notion of ubuntu and communalism in African educational discourse. *Studies in Philosophy and Education*, 23, 149-160.
- Voukelatou, G. (2019). The contribution of experiential learning to the development of cognitive and social skills in secondary education: A case study. *Education Sciences*, 9(2), 127. <https://doi.org/10.3390/educsci9020127>.

- Vygotsky, L. S. (1978). Learning and mental development at school age. In B. Simon & J. Simon (Eds.), *Educational psychology in the U.S.S.R.* Routledge.
- Watson, J., Wright, S., Allen, J. M., Hay, I., Cranston, N., & Beswick, K. (2017). Increasing students' social capital through community involvement in rural and regional education. *Australian and International Journal of Rural Education*, 27(3), 142-157.
- Webb, P. (2013). Xhosa indigenous knowledge: Stakeholder awareness, value and choice. *International Journal of Science and Mathematics Education*, 11(1), 89-110.
- Wieck, G., Leventer, R. J., Squier, W. M., Jansen, A., Andermann, E., Dubeau, F.,... & Dobyms, W. B. (2005). Periventricular nodular heterotopia with overlying polymicrogyria. *Brain*, 128(12), 2811-2821.
- Wertsch, J. (2008). From social interaction to higher psychological processes: A clarification and application of Vygotsky's theory. *Human Development*, 51, 66-79.
- Willis, J. (1995). A recursive, reflective instructional design model based on constructivistinterpretivist theory. *Educational Technology*, 35(6), 5-23.
- Wilujeng, I., & Prasetyo, Z. K. (2018). Elaborating indigenous knowledge in the science curriculum for the cultural sustainability. *Journal of Teacher Education for Sustainability*, 20(2), 74-88.
- Woolfolk, R. L., & Richardson, F. C. (2008). Philosophy and psychotherapy. *Journal of Psychotherapy Integration*, 18(1), 25.
- Zidny, R., & Eilks, I. (2020). Integrating perspectives from indigenous knowledge and Western science in secondary and higher chemistry learning to contribute to sustainability education. *Sustainable Chemistry and Pharmacy*, 16, 100229.

Appendices

APPENDIX A: Ethical Clearance



Rhodes University, Education Faculty
Research Ethics Committee
PO Box 94, Makhanda, 6140, South Africa
Tel: +27 (0) 46 603 8393
Fax: +27 (0) 46 603 8028
email: e.rosenberg@ru.ac.za

<https://www.ru.ac.za/researchgateway/ethics/>

26 September 2023

Prof Kenneth Ngcoza

Education Department

K.Ngcoza@ru.ac.za

Dear Prof Kenneth Ngcoza and Ms Hlengiwe Tshitshi

Re: Mediating learning of the topic of sound through cultural music and dance stories to Grade 4 farm school learners.

APPLICATION NUMBER: 2023-7184-7979

This letter confirms that your research ethics application has been reviewed and **APPROVED** by the Education Faculty Research Ethics Committee (EF-REC). Your permission letter(s) where applicable have been received and you are free to proceed with your study. Approval is granted for 1 year. An annual progress report is required in order to renew approval for an additional period. You will receive an email notifying you when the progress report is due. Should any substantive change(s) be made during the research process, that may have ethical implications, you should notify the Education Faculty REC Chair via email. This includes changes in investigators. The REC Chair will advise as to whether a new application is necessary. Do keep this clearance letter secure and accessible throughout your study and after its completion. It will be needed when a thesis is examined and when publications are submitted to journals. Please also submit a brief report to the REC Chair on the completion of the research. This can be done via email. The purpose of this report is to indicate whether the research was conducted successfully and whether any ethics-related matters arose that the committee should be aware of, in order to guide future studies. Sincerely,

Prof Eureka Rosenberg

Chair: Education Faculty Research Ethics Committee

APPENDIX B: Letter to the Eastern Cape Department of Education

The Director: Corporate Planning, Policy, Monitoring and Research Coordination

Eastern Cape Department of Education

Private Bag X 0032

Bhisho

5605

Dear Sir/ Madam

Subject: Request for permission to conduct educational research with Grade 4 learners at Riebeeck East Combined School in the Sarah Baartman District.

The research topic is: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

I am Hlengiwe Tshitshi (Student number:17T4378), a part- time student doing Masters in Science Education with Rhodes University and a Natural Sciences and Technology and Mathematics teacher at Riebeeck East Combined School (RECS). I hereby humbly request your permission to conduct a research study with learners at RECS which is in the Eastern Cape Department of Education starting in September 2023. The purpose of the study is to make science relevant and accessible through using the stories of traditional musical instruments to support Grade 4 Natural Sciences and Technology learners to make sense of the topic sound and movement. The study will require the Grade 4 Natural Sciences and Technology learners to be participants.

I will also invite two community members to the school where they will share their lived experiences and knowledge on cultural music and dance by telling their stories to the learners. Learners will be required to listen, observe and interact with the community members. Additionally, have designed a module that integrates learners' local indigenous knowledge and I will use it to mediate learning of the concepts of sound and movement. One of the Grade 7 science teachers in the school will be my critical friend. He will observe the lesson presentation done by me and how the community members share their wisdom and stories on traditional music and how the learners interact with them. These will be done during working hours.

Written consent will be sought from all the participants (community members, the parents or guardians of the learners, and the learner themselves). In addition, a verbal explanation of the entire research process, their requested role, and their right to participate or not and to pull out of the study at any stage will be given to the Grade 4 learners. This will be followed by written assent letters from the learners.

I would like to assure your office that, should I be granted permission, the research ethics as laid down by the Rhodes University Ethics Committee will apply throughout the process of the study. The data collected will be transcribed and (hard and soft copies) will be kept in the school safe in the strong room for at least a period of five years. The data collected will be used for reporting in my thesis and publications. I am aware that there might not be complete anonymity because we will be co-creating knowledge with participants in this study, but I want to reassure you that ethical standards will be upheld at all time.

The Rhodes University Ethics Committee can be contacted on:

Research Office, Ethics Coordinator: ethics-committee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

Your consideration in this regard will be highly appreciated.

Yours Faithfully

Hlengiwe Tshitshi (School teacher, Riebeeck East Combined School, and Rhodes University student)

Email address: hlengiwengcebo@gmail.com

Cell number: 0724993303

APPENDIX B2: Letter to the Principal of Riebeeck East Combined School

The Principal

Riebeeck East Combined School

2 Morgan Street

Makanda CMC

Sarah Baartman District

Riebeeck East

5600

Dear Sir

Subject: Request for permission to conduct educational research with Grade 4 learners at Riebeeck East Combined School in the Sarah Baartman District.

The Research Topic: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

I am Hlengiwe Tshitshi, a part-time student doing Masters in Science Education with Rhodes University, South Africa. I hereby humbly request your permission to conduct a research study with my Grade 4 Natural Sciences and Technology (NS-Tech). and the data gathering will be done in September 2023. The purpose of the study is to make science relevant and accessible through the integration of learners' local indigenous knowledge in science. The study will focus on the use of stories of traditional musical instruments to support Grade 4 learners to make sense of the topic of sound and movement. The study will require the participation of my Grade 4 Natural Sciences and Technology learners and a Grade 7 Natural Sciences teacher (my critical friend). Learners will be required to:

1. Observe and interact with the two community members who will be presenting using stories about traditional musical instruments.
2. Present in class what they have observed and learned while my critical friend will observe a lesson that I will teach.

Written consent will be sought from the parents or guardians of the learners and written assent will be sought from the learners themselves. Additionally, I will teach a lesson using a module that integrates indigenous knowledge in science.

I would like to assure your office that, should I be granted permission, the research ethics as laid down by the Rhodes University Ethics Committee will apply throughout the process of the study. The data collected and transcribed (hard and soft copies) will be kept in the school safe in the strong room for at least a period of five years. The data collected will be used for reporting in my thesis and publications. I am aware that there might not be complete anonymity because we will be co-creating knowledge with participants in this study, but I want to reassure you that ethical standards will be upheld at all time. The ethics committee can be contact on:

Rhodes University, Research Office, Ethics

Ethics Coordinator:ethics-commitee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

Your consideration in this regard will be highly appreciated.

Yours Faithfully

Hlengiwe Tshitshi

Grade 4 NS-Tech Teacher and Rhodes University Student - Student number:17T4378)

APPENDIX B3(a): Letter to the Natural Sciences Teacher (Critical Friend)

Enquiries: Ms. Tshitshi H.

Cell number: 0724993303

Dear

Ms WB Mvandaba

Re: Participation in research on the integration of local or indigenous knowledge when teaching the topic sound and movement in the Grade 4 Natural Sciences and Technology class

The Research Topic: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

I am Hlengiwe Tshitshi, a part-time student doing Masters in Science Education at Rhodes University, South Africa. I am Natural Sciences and Technology and Mathematics teacher at Riebeeck East Combined School (RECS) in the Sarah Baartman District. I hereby humbly request you to be my critical friend in my Master of Education research study which will also include Grade 4 learners at RECS.

The study will focus on the mediation of learning of sound through cultural music and dance stories to Grade 4 learners. I will invite two community members to the school where they will share their lived experiences and knowledge of cultural music and dance by telling their stories to the learners. Learners will be required to (a) listen to the stories and interact with two community members, and (b) present in class. The community members will be presenting using stories about traditional musical instruments and these activities will be observed and videotaped. Your role will be to observe and video record the lessons, co-planning of lessons that include indigenous knowledge, and assist in translating from isiXhosa to English.

I will interview and videotape the learners and the community members. Written consent will be sought from the parents or guardians of the learners' and the written assent will be sought from learners themselves. In addition, you will be required to check and verify the findings of the study, this will help in validating the findings. I plan to conduct the study in September 2023. Kindly be informed that participation in this study is voluntary. It is therefore your right to decide whether you wish to participate or not. Also, participants are free to withdraw at any time as they wish to do so.

I am aware that there might not be complete anonymity because we will be co-creating knowledge with participants in this study, but I want to reassure you that ethical standards will be upheld at all time. The data that will be collected will not be used for other purposes apart from this study. The data collected (hard and soft copies) will be kept in the school safe for at least a period of five years. The data

collected will be used for reporting in my thesis and publications. The Rhodes University Research Ethics Committee can be contacted as follows: Rhodes University, Research Office, Ethics

Ethics Coordinator:ethics-commitee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

I can be reached at 0724993303 or email (hlengiwegcebo@gmail.com).

Note: My supervisors Prof. Kenneth M. Ngcoza at Rhodes University, email address (k.ngcoza@ru.ac.za), and my co-supervisor Mr Alfred Mapfumo, email address (akmapfumo@gmail.com)

Your consideration will be highly appreciated in this regard.

Lastly, if you agree or do not agree to participate in this research, please complete the consent form below.

I (full name of the teacher), hereby confirm that I understand the content of this document and the nature of the research. I henceforth request you to indicate your choice by making a cross (X) in the appropriate box below.

Agree to participate in the study.....

Do not wish to participate in the study.....

Signature: ----- Date:-----

Yours Sincerely

Hlengiwe Tshitshi

Part-time M.Ed. Student -(Student number: 17T4378)

Rhodes University

APPENDIX B3(b): Natural Sciences teacher (critical friend) Informed Consent Letter



RHODES UNIVERSITY
Where leaders learn

(PARTICIPANT)

PROJECT TITLE: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

Hlengiwe Tshitshi (17T4378), currently a master student at Rhodes University, has requested my permission to participate in the above-mentioned research project. The nature and purpose of the research project and of this informed consent declaration have been clearly explained to me in a language that I understand.

I am therefore aware that:

1. The purpose of this study is to mediate learning sound through cultural music and dance stories to Grade 4 farm school learners.
2. I will observe together with the researcher, learners when they participate, interact and argue when community members are telling stories about their cultural music and dance. The presentation will take place in the classroom, and will videotape the presentation with permission from participants. This will take place after school hours to avoid disturbing tuition time.
3. That I will be observing the researcher when presenting a lesson in a Grade 4 Natural Sciences and Technology class. This will take place during school hours when I do not have periods. The lesson will take two hours.

4. By participating in this research project, I will contribute to knowledge and understanding how the practical demonstrations by expert community members have facilitated my knowledge which I will use to develop videos that contain IK.
5. My participation is entirely voluntary and should I at any stage wish to withdraw from further participation, I may do so without any prejudice.
6. I understand that participating in this study is voluntary and that I will not be compensated for participating.
7. The names of participants will be clan names, unless if they express in writing their willingness to have their names included in the study.
8. There may be risks associated with my participation in the project. I am therefore aware of the following steps:
 - a) All information shared is strictly confidential and will not be used for purpose other than of the above-mentioned research project.
 - b) All the data collected will be kept in a locked cupboard and electronic data will be kept in a computer and hard drive only accessible through a secure password kept by me; and
 - c) The researcher intends to publish the research findings in the form of a thesis towards a Masters degree in Science Education, and later present it in conferences or journal articles. However, anonymity will be maintained.
9. Any further questions that I might have concerning the research or my participation will be answered by the Rhodes Hlengiwe Tshitshi student (hlengiwengcebo@gmail.com) or the supervisor Professor Kenneth Mlungisi Ngcoza (k.ngcoza@ru.ac.za) or the cosupervisor Mr Alfred Mapfumo (akmapfumo@gmail.com).
10. By signing this informed consent declaration, there are no legal implications.

11. A copy of this informed consent declaration will be kept in a safe place by the researcher.

I,have read the above information or confirm that the above information has been explained to me in a language that I understand. I am therefore aware of this document's contents. I have asked all questions that I wished to ask, and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been coerced or pressurised in any way, and I understand that nonymity might not be possible because we will be co-creating knowledge in this study. I therefore voluntarily agree to participate in the above-mentioned research project.

.....

.....

Participant's signature Witness

Date

Date

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

T: +27 (0) 46 603 7335 F: +27 (0) 82 739 4378

Room 220, Main Admin Building, Drostdy Road, Makhanda, 6139

APPENDIX B4(a): Letter to the Community Members

Enquiries: Ms Tshitshi H.

Cell number: 0724993303

Dear Sir/Madam

Re: Permission letter: Presentation to learners.

I am Hlengiwe Tshitshi (student number: 17T4378), a part-time student doing master's in science education with Rhodes University, South Africa and a teacher at Riebeeck East Combined School. I am a Natural Sciences and Technology and Mathematics teacher at Riebeeck East Combined School. I hereby humbly request your permission to be a research participant in my research project that I will be conducting with my Grade 4 Natural Sciences and Technology learners at Riebeeck East Combined School. The focus of the study will be using stories about traditional musical instruments to support Grade 4 Natural Sciences and Technology learners from a farm school to make sense of the topic sound and movement. I plan to conduct the study in September 2023.

Since the focus of the study will be on the use of stories about traditional musical instruments to support Grade 4 Natural Sciences and Technology learners to make sense of the topic sound and movement, your main role will be to tell stories to the Grade 4 Natural Sciences and Technology learners about sound waves.

Your participation in this study is completely voluntary and you can withdraw at any stage you wish. If you agree or not agree to participate kindly sign the consent below. I am aware that there might not be complete anonymity because we will be co-creating knowledge with participants in this study, but I want to reassure you that ethical standards will be upheld at all time.

The Rhodes University Ethics Committee can be contacted on:

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

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

Agree.....
.....

Not
agree.....
.....

Signature:.....

Your cooperation will be highly appreciated.

I can be reached at 0724993303 or email (hlengiwegcebo@gmail.com) Note: My supervisor is Prof. Kenneth M. Ngcoza at Rhodes University, email address (k.ngcoza@ru.ac.za) and my co-supervisor is Mr Alfred Mapfumo, email address(akmapfumo@gmail.com)

Yours Faithfully

Hlengiwe Tshitshi

APPENDIX B4(b): Translation

Mhlekaazi/ Nkosazana ebekekileyo,

Igama lam ngu Hlengiwe Tshitshi umfundisi-ntsapho we Zibalo ne Nzululwazi e Riebeeck

East Combined School. Ndicela ukuba uthathe inxaxheba kuphando kwi zifundo zam zakwi

Dyunivesithi yase Rhodes. Uphando lwam ndizakulwenza eRiebeeck East Combined School, lunxulumene nokuphanda umdla wabafundi ukuzama ukuphuhlisa kokufundiswa kweNzululwazi kwibanga lesine. Kolu phando ndizakuzama ukudibanisa ulwazi nenkcubeko efumaneka eluntwini nasekuhlaleni jikelele xa kufundiswa ngesandi.

Oluphando luzakuthatha izigaba ezithathu. Sigxile kakhulu ukufundisa nokucacisela abafundi notitshala weNzululwazi ukuba luthinina ulwazi lwemveli ngokuhamba kwesandi. Injongo ephambili yolu phando kukujonga ukuba kungakwazi na ukuhlanganiswa ulwazi lwemveli neNzululwazi yase Ntshona, ukuzama ukukhulisa umdla wabafundi kwezeNzululwazi. Ndiyazithoba ndikwakucela kanjaqo ukuba uzokusifundisa, ngolwazi lwemveli ngokuhamba kwesandi. Uphando lwam ndilucwangcisele ukulenza ngoSeptember.

Ndakuvuyiswa yinxaxheba yakho koluphando. Imithetho ye Dyunivesithi ke ayibopheleli abathathi nxaxheba lonto ithetha ukuba banako ukurhoxa nanini na xa befuna njalo. Ndiyakuqinisekisa nakanjalo ukuba ulwazi olufumaneke koluphando aluyikunikwa nabanina ngaphandle kwemvume yakho. Ukanti, igama lakho aliyikuchazwa esidlangalaleni ngaphandle kwemvume yakho. Siye ke safumanisa ukuba masenze oluphando lokuba sazi ukuba yintoni eyenza umdla nendlela abacinga ngayo abantwana xa beyinxalenye kusenziwa uphando nzulu kwizifundo zeNzululwazi ingakumbi kwisandi.

Ukuba unombuzo malunga noluphando, nceda utsalele umnxeba kum kolu cingo 0724993303, hlengiwegcebo@gmail.com, okanye iingqonyela endiphantsi kwazo uProf. Kenneth M. Ngcoza kulomxeba 046 603 7269, k.ngcoza@ru.ac.za okwiSebe lwezeMfundo kwi Dyunivesithi yase Rhodes, okanye uMnumzana Alfred Mapfomo, akmapfumo@gmail.com

Ncincilili!!!

Ndiyakucela kanaanjalo ukuba uncede uzalise esi siqendu silandelayo

Mna Mnumzana (igama lakho)

Ndiyavuma OKANYE Andivumi (Khetha ngokufaka X) ukuthatha
inxaxheba koluphando.

Tyikitya

Inombolo yomnxeba

Ozithobileyo

Hlengiwe Tshitshi

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707 Room 220, Main
Admin Building,

Drostdy Road, Grahamstown, 6139

APPENDIX B5(a): Letter to the Parent(S) / Guardian(S)

Enquiries: Ms. Tshitshi H.

Cell number: 0724993303

Dear Sir/Madam

RE: Participation in research on the integration of local indigenous knowledge when teaching the topic sound and movement in Grade 4 Natural Sciences and Technology class.

Research Topic: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

I am Hlengiwe Tshitshi (student number: 17T4378) a part-time student doing Masters in

Science Education at Rhodes University, South Africa, and a teacher at Riebeeck East Combined School. I hereby humbly request your permission to allow your child who is studying at Riebeeck East Combined School to take part in my research. I intend to conduct the study in September 2023. The focus of the study is on using stories of traditional musical instruments to support Grade 4 Natural Sciences and Technology learners from a farm school to make sense of the topic of sound and movement. Kindly be informed that participation in this study is voluntary. It is, therefore, the right of the parent(s) or guardians to decide whether his/her child should participate or not. Also, participants are free to withdraw at any time as they wish to do so. I am aware that there might not be complete anonymity because we will be co-creating knowledge with participants in this study, but I want to reassure you that ethical standards will be upheld at all time.

The Rhodes University Ethics Committee can be contacted on:

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

If you have any questions about the research, please feel free to contact me at 0724993303, email address (hlengiwegcebo@gmail.com) or my supervisor Prof. Kenneth Ngcoza, email address (k.ngcoza@ru.ac.za) and Mr Alfred Mapfumo, (akmapfumo@gmail.com). 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 contents 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

Hlengiwe Tshitshi

(Student number: 17T4378)

APPENDIX B5(b): Translation

Mzali obekekileyo,

Mna ndingu Hlengiwe Tshitshi umfundisi-ntsapho we Zibalo ne Nzululwazi e Riebeeck East Combined School. Ndiyakucela ngokuzithoba undimele ndisebenze nawe kuphondo lwam xa ndizakube ndifundisa isihloko singe sandi nentshukumo. Esi Sifundo sizobe sigxile kumculo wemveli nenkcubeko nomxhentso ngokubalisa amabali kwibanga lesi-4 kwisikolo esisemaphandleni.

Njengomncedisi wam kwiphondo, inxaxheba yakho iquka:

- a) Ukuqokelela ulwazi kubahlali benginqi.
- b) Ukwenza ingxelo eklasini.
- c) Ukusebenza nokwabelana nabahlali xa bebalisa lamabali abo ngomculo wesintu. Zonke ke ezinqubo ziyakushicelwa zipapashwe ngokuxhaxhaka lalemihla ukuze zikwazi ukukhumbuleka. Lonke ke ushicelelo oluwenziweyo luya kusetyenziswa kuphela ndim nabahloli bam.

Kulindeleke ukuba imvume ebhalwe phantsi yokuthatha inxaxheba koluphondo ityikitywe ngumzali nomfundi kwanomfundi ubuqu. Ndizakusebenza nomnye umhlali wesifundo senzululwazi neteknoloji webanga lesi-7, yena aqaphele aphula-phule ethatha amanqaku ngexesha abahlali bebalisa lamabali ngomculo wesintu.

Imibuzo malunga nalenkcazelo ingentla yamkelekile.

Ukuba unento ekukhalabisayo ngoluphando, ungaqhaga-mshelana nabacebisi bam kwezi nkcukacha zonxibelelwano zingezantsi:

Ukuba unombuzo malunga noluphando, nceda uqhagamshelane nam kulo mnxeba, 0724993303, hlengiwengcebo@gmail.com okanye iingqonyela zam endiphantsi kwazo uProf. Kenneth M. Ngcoza, kngcoza@ru.ac.za okwisebe lezeMfundo kwiDunivesiti yase Rhodes okanye umncedisi wakhe uMnu Alfred Mapfumo.

Ndibamba ngazo zozibini

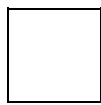
Ndiyakucela kwakhona ukuba uncede uzalise esisiqendu silandelayo.

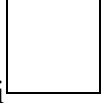
Mna

Mzali/Mmeli.....

.... (igama lomntwana wakho lakho),

ka.....



Ndiyavuma Andivumi  (khentha ngokufakela

X) kwibokisi

Tyikitya.....

Inombolo yomnxeba.....

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

Telephone: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building,

Drostdy Road,

Grahamstown, 6139

Ozithobileyo

Hlengiwe Tshitshi

APPENDIX B6(a): Letter to the Learner

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

T: +27 (0) 46 603 7335 F: +27 (0) 82 739 4378

Room 220, Main Admin Building, Drostdy Road, Grahamstown 6139



Dear Learner

My name is Hlengiwe Tshitshi. I hereby humbly request your permission for me to conduct a research study with you as my co-researcher, during teaching and learning of the topic sound and movement. The study will be mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

You will be required to (a) collect data from community members, (b) present in class, (c) interact with two community members who will be presenting stories about traditional musical instruments, and these activities will be observed and videotaped so that I can remember well what happened in the lesson. Any part of the recording that you might appear in will only be shown to my supervisors, and no one else. A written consent will be sought from the parents or guardians of the learners' and the learners themselves. I will also work with a Grade 7 Natural Sciences teacher to observe the two community elders telling stories about traditional musical instruments. The focus of the study is to mediate how the use of stories of traditional musical instruments can support Grade 4 Natural Sciences and Technology learners to make sense of the topic sound and movement.

Please ask me if you have any questions about what we will be doing together. If you are worried about anything to do with this project, the details of who you can contact are listed here:

Rhodes University, Research Office, Ethics

Ethics Coordinator: [ethics-
committee@ru.ac.za](mailto:ethics-committee@ru.ac.za) t: +27 (0) 46
603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building, Drostdy Road, Grahamstown, 6139

APPENDIX B(b): Translation

Mfundi obekekileyo (Igama lomfundi)

Igama lam ndingu Hlengiwe Tshitshi umfundisi-ntsapho we Zibalo ne Nzululwazi e Riebeeck East Combined School. Ndicela ukuba uthathe inxaxheba kuphando kwi zifundo zam zakwi Dyunivesithi yase Rhodes. Ukuzama ukukhulisa umdla wabafundi xa kufundiswa iNzululwazi kwibanga lesine. Kulo phando kuzakudityaniswa ulwazi nenkcubeko olufumaneka eluntwini nasekuhlaleni jikelele xa kufundiswa iindidi zokutya.

Ukuba uyavuma eyakho indima iyakuquka, (a) ukufilisha imibuzo yophando, (b) uyokufuna ulwazi kubantu abadala ekuhlaleni olungqamene noluphando, (c) wabelane nabanye abafundi eklasini ngophando lwakho, kwa (d) ubeyinxalenye yabafundi abazakufundiswa ziingcali zasekuhlaleni ngolwazi lwemveli olunxulumene noluphando, uzibuzele imibuzo kubo.

Ukuba unombuzo malunga noluphando, nceda utsalele umxeba kum kolu cingo 0724993303, hlengiwengcebo@gmail.com, okanye ingqonyela nengqonyelakazi endiphantsi kwazo uProf. Kenneth M. Ngozoza kulomxeba 046 603 7269, k.ngcoza@ru.ac.za okwiSebe lwezeMfundo kwi Dyunivesithi yase Rhodes, okanye uMnumzana Alfred Mapfumo, akmapfumo@gmail.com naye okwiSebe lwezeMfundo kwi Dyunivesithi yase WSU.

Ndiyakucela kananjalo ukuba uncede uzalise esi siqendu silandelayo ukuba uyavuma okanye awuvumi ukuthatha inxaxheba.

Mna mfundi (igama lakho).

Ndiyavuma OKANYE Andivumi (Khetha ngokufaka X) ukuthatha inxaxheba koluphando.

Tyikitya

Inombolo yomnxeba

Ozithobileyo

Hlengiwe Tshitshi

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-committee@ru.ac.za

T: +27 (0) 46 603 7335 F: +27 (0) 82 739 4378 Room 220, Main Admin Building, Drostdy

Road, Grahamstown 6139

APPENDIX B(c): Child Participant's Assent Form

INFORMED CONSENT DECLARATION

(Child participant)



Project Title: Mediating learning sound through cultural music and dance stories to Grade 4 farm school learners.

Researcher's name: Ms Hlengiwe Tshitshi

Name _____ **of** _____ **participant:**

.....

1. Has the researcher explained what s/he will be doing and wants you to do?

YES

NO

2. Has the researcher explained why s/he wants you to take part?

YES

NO

3. Do you understand what the research wants to do?

YES

NO

4. Do you know that your name and what you say will not be shown to other people?

YES

NO

5. Did you ask the researcher any questions about the research?

YES

NO

6. Has the researcher answered all your questions?

YES

NO

7. Do you understand that you can refuse to participate if you do not want to take part and that nothing will happen to you if you refuse?

YES

NO

8. Do you understand that you may pull out of the study at any time if you no longer want to continue?

YES

NO

9. Do you know who to talk to if you are worried or have any other questions to ask?

YES

NO

10. Has anyone forced or put pressure on you to take part in this research?

YES

NO

11. Are you willing to take part in the research?

YES

NO

Signature of Child

Date

CHILD PARTICIPANT'S ASSENT FORM

INFORMED CONSENT DECLARATION

(Child participant)



Isihloko sophando : *Ukulamla ukufunda kwesandi ngokubaliswa kwamabali kunye nomxhentso wesintu.*

Igama lomphandi : Ms Hlengiwe Tshitshi

Igama lomthathi-nxaxheba :

.....

1. Ingaba umphandi ukucacisele yonke into azokuyenza kwakunye nafuna wena uyenze?

EWE

HAYI

2. Ingaba umphandi ukucacisele na ukuba kutheni efuna wena uthathe inxaxheba?

EWE

HAYI

3. Uyayiqonda na into ezanywa ekwenziwa ngoluphando?

EWE

HAYI

4. Uyayazi ukuba igama lakho nezinto ozozitsho koluphando azizokuboniswa abanye abantu?

EWE

HAYI

5. Umbuzile umphandi imibuzo nayiphi ngoluphando?

EWE

HAYI

6. Ingaba umphandi uyiphendule yonke imibuzo yakho?

EWE

HAYI

7. Uyaqonda ukuba ungangavumi ukuthabatha inxaxheba koluphando ukuba uyafuna, kwaye akukho nto izakwehlela ukuba akuvumanga?

EWE

HAYI

8. Uyaqonda ukuba ungayeka ukuthabatha inxaxheba koluphando nanini na xa uziva ungafuni ukuqhubeka?

EWE

HAYI

9. Uyazazi ukuba ungathetha nabani xa uziva ukhathazekile okanye unemibuzo ngoluphando?

EWE

HAYI

10. Ukhona umntu okunyanzelisa ngokuthabatha inxaxheba koluphando?

EWE

HAYI

11. Uyavuma ukuthabatha inxaxheba koluphando?

EWE

HAYI

Utyikityo lomfundi

Umhla

APPENDIX C: Proposed Time Frame

Table 1: Proposed time frame for this study

Date	What to do
Jan – Feb 2022	Writing of research proposal
April – June 2022	Submission of refined research topic
July – Sept 2022	Submission of the first draft research proposal
October – November 2022	Submission of final research proposal
Jan – Feb 2023	Submission of second research draft proposal
March – April 2023	Submission of research proposal to High Degree Committee and answering questions on ethical consideration and completing ethics form
May 2023	Draft of literature review, methodology chapters
June – July 2023	Data collection and analysis
August – Sept 2023	Data analysis and discussion of findings
October 2023	Submission of first draft
November – Dec 2023	Editing and submission of final full thesis for examination

APPENDIX D: Data-gathering Methods

Table 2: Shows the tools, methods and purpose for the gathering of information.

Stage	Method to be used to gather data	Purpose	Research questions
Stage 1	Focus Group Interview	To find out the learners' cultural beliefs and practices on traditional music and dance.	1 & 2
Stage 2	Group Activity	To find out learners' knowledge on cultural beliefs and practices about sound.	3
Stage 3	Observation	Learners observing members of the community while presenting about cultural beliefs and practices about sound.	3
Stage 4	Learners' journal reflections	To find out the influence of model lessons that integrate IK in the teaching of science.	1

APPENDIX E: Focus Group Interview Schedule

1. What do you understand by the term local knowledge?
2. What are your views on the integration of local knowledge in science lessons?
3. What relevance does knowledge from home or community have at school?
4. What local knowledge do you think would be important to learn sound?
5. What do you think what could be the **benefits** of including local knowledge in teaching the topic of sound?
6. What do you think could be the **challenges** for including local knowledge in teaching the topic of sound?
7. Is there anything else that you would like to share with me?

APPENDIX F: Group Activity

1. What are some stories about traditional practices that you know from your homes or community related to sound and traditional musical instrument?
2. What stories about cultural beliefs related to traditional musical instrument and sound do you know from your homes and community?
3. What relevance do you think these stories about cultural beliefs and practices have in science?

APPENDIX G: Observation Schedule (adapted from Nikodemus, 2017)

Observation Date.....

Name of the teacher:

Subject: Number of participants:

Lesson Topic: Observer:

Social interaction	Remarks
The participation of learners during the presentations by the community member.	
The interaction of learners with one another.	
The interaction of learners with the community members.	
How community member takes learners' views.	
How learners are motivated during the presentation.	
Learners responding to their peers' thoughts and discussions.	
Sense making	Remarks
Learners' everyday ways of reasoning is scientific.	
Learners construct clear scientific explanations from the demonstration.	
Learners' questioning invites thinking.	

Learners' interpretations of concepts and ideas emerging from demonstration.	
Learners exploring concepts and ideas emerging from demonstration.	
Learners reached their 'aha' moments.	

APPENDIX

APPENDIX H: Journal Reflections Instruction: Answer all the following questions

1. What have you learned from this lesson?

.....
.....
.....
.....
.....

2. What have you enjoyed in this lesson?

.....
.....
.....
.....

3. What have you not enjoyed in this lesson?

.....
.....
...
.....
...
.....
...
.....

4. How can the lesson be improved?

.....
.....

APPENDIX I: Focus Group Interview Schedule

Title

Mediating learning of the sound through cultural music and dance stories to Grade 4 farm school learners.

FOCUS GROUP INTERVIEW SCHEDULE

1. What do you understand by the term local knowledge?

Mfene: *Ndicinga igama elithi local knowledge lulwazi esiluthola kubazali bethu,*
I think the term local knowledge is **the knowledge we get from our parents.**

MamBamba: *Lulwazi olungafundiswa kodwa silufumana ngokujonga ekuhlaleni.*

It is the knowledge that is not taught to us but **we get it by observing from the community.**

MamBathane: *Lulwazi olufumaneka kubazali* Is
the **knowledge from our parents.**

Mangqosini: Lulwazi lwendawo

Is the **knowledge from our community.**

2. What are your views on the integration of local knowledge in science lessons? **Mfene:** *Ndicinga ukuzisa ulwazi lwasemakhaya kwizifundo zenzululwazi kungakuhle kuba singanxulumanisa nalo ukuze sivakale kakuhle isandi.*

I think bringing local knowledge in our science lessons will be great because I **will connect it with to make sense of the topic.**

MamJwarha: *Ingenza isifundo senzululwazi sibe lula kwabanye bethu abasokolayo ukuqonda.*

It will make science lesson easy for some of us who **were struggling to understand.**

3. What relevance does knowledge from home or community have at school?

Mqocwa: *Ukuhlobana kukuba ekhaya ndiva izandi ezahlukileyo nasesikolweni siyafundiswa ngesandi.*

The relevance is that at home we hear different sounds and at school we are taught about sound.

MamJwarha: *Ekhaya iyabethwa impempe nasesikolweni.*

At home and at school we blow whistle.

4. What local knowledge do you think would be important to learn sound?

MamNgqosini: *Kubalulekile ukuba sifunde ngesandi kuba sitsho sazi ukuba xa ingxolo ininzi yenzakalisa iindlebe zethu.*

It is important to learn about sound, because they make us aware that too much noise can damage our ears.

MamBamba: *kubalulekile kuba xa abanye bengxola sizobakhuza khon'ukuze singonzakalelwa ziindlebe.*

It is important because when others are making noise we will tell them to be quiet so that our ears cannot be damaged.

5. What do you think what could be the benefits of including local knowledge in teaching the topic of sound?

MamQocwa: *Izakwenza abafundi banxulumanise batsho baqonde inzululwazi lula.*

The benefits are it make learners connect and understand science easy.

MamNgqosini: *Ingasinceda ukuba siphumelele izifundo zethu.*

It can help us to pass our subjects.

6. What do you think could be the **challenges** for including local knowledge in teaching the topic of sound?

Mqocwa: Bangayisenzisa kakubi.

They can **misuse the local knowledge**. (myth)

7. Is there anything else that you would like to share with me?

APPENDIX J: Learners' Journal Reflections

Questions	Mqocwa	MaMbam ba	MaMqoc wa	MamBath ane	MaMngqos ini	Mfene	MamJwarh a
1. What have you learned from this lesson?	I have learnt that there are many different types of sounds and that includes drums made at home guitars and any other instruments	I have learnt how sound travels and how to dance.	In this lesson I learnt that we have different types of instruments and I love to beat the drum.	I have learnt that whistle has the loudest sound than other instruments.	I have learnt to play a drum without making noise.	In this lesson I learnt that sound can be high or low, if the sound is too high can damage our eardrums.	In this lesson I learnt a sound can be high
2. What have you enjoyed in this lesson	I enjoy playing the drum and listening to the lesson	I have enjoyed the examples of the lesson were related to the things we have at home.	I enjoyed the sound of traditional dance.	I enjoyed the sound of uhadi. I love the sound of it.	I enjoyed this lesson because the teacher was making examples about indigenous knowledge. That made the lesson interesting.	I enjoyed this lesson because the teacher was referencing to the things we know from our homes, for example at home we know about drums.	I enjoyed the examples of the things we can also make at home
3. What have you not enjoyed in this lesson?	The sound was too loud	Some learners were playing too loudly	Some learners were disturbing	the sound of the drum was too loud for me.	My ears were painful from the loud sound of a drum.	I did not like the drum's sound.	They did not play the drum well
4. How can this lesson be improved?	By adding other traditional instruments and hear when different instruments are combined together	By bringing my grandmother, she can help us learn more things	By including all of us to bring different types of traditional instruments	By calling our grandmother to teach us about our tradition.	By calling older people to teach us other things.	By bringing our grandmothers to the lesson	By inviting the knowledgeable person in our community

APPENDIX K: Learners' matching activity column A with column B

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers

1. Match each musical instrument in Column A with the description of how to play it in Column B.

Column A	Column B
Instrument	Input of movement energy
a. Tambourine	Blow air through it
b. Guitar	Hit it with sticks or with your hand
c. Drum	Shake it or tap it
d. Whistle	Pluck or strum the strings with your fingers