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Indigenous knowledge and school science: possibilities for integration

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INDIGENOUS KNOWLEDGE AND SCHOOL SCIENCE: POSSIBILITIES FOR INTEGRATION

Constance Khupe

A thesis submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements of the degree of Doctor of Philosophy.

Johannesburg, 2014

DECLARATION

I declare that this thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy in the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree in any other University.

---------- day of ---------- 2014

ABSTRACT

Prior to democracy in South Africa, education was used as a means to achieve segregation, privileging a minority of the population in both economic and worldview domination. With the attainment of democracy in 1994, educational reform was aimed at getting rid of both apartheid content and method. The aims and principles of the new curricula (the Revised National Curriculum Statement Grades R-9, the National Curriculum Statement Grades 10-12, and later on, the Curriculum and Assessment Policy Statements) were aligned to those of the national constitution, which include the establishment of human rights, inclusivity, environmental and social justice, and valuing of Indigenous knowledge systems. In the science subjects, teaching and learning are expected to acknowledge the existence of different knowledge systems. In the absence of clear guidelines as to which Indigenous knowledge to include and how, the recognition of IKS in science classroom has largely been left to the teachers' discretion.

The purpose of this interpretive research study, carried out in collaboration with a rural community in KwaZulu-Natal Province, was three-fold. The first was to identify the Indigenous knowledge held by the community and the worldview underpinning that knowledge. The second was to find out what knowledge could be integrated with classroom science, and explore ways in which such integration could be done, considering students' and community worldviews. The third was for the research to contribute to transformation in Indigenous knowledge research by following methods that recognised Indigenous knowledges, practices and languages as valuable. The findings from this study underscore the importance of extending the thinking about IKS-science integration beyond aspects that suit science content, to considering methods of teaching and learning science, as well as considering relevance to community needs.

DEDICATION

In memory of my mother, Varaidzo Priscilla Chikuni (1946-2005), and her mother Rachel Chikuni (1904-2011) both of whom taught me *ubuntu* and the love for school.

ACKNOWLEDGEMENTS

I would like to thank my supervisor and project leader of the Indigenous knowledge, Science Curriculum and Development Project, Dr Moyra Keane, for the sustained support throughout the study, and more especially for the support given during the fieldwork days. Thanks also to my co-supervisor, Dr Ann Cameron for her on-going encouragement throughout the study. My supervisors' support during my 'intense' writing months will be eternally appreciated.

I most sincerely thank the students, teachers and Elders of Mqatsheni, and everyone who participated in this study:

- the Grade 11 classes of 2010 and 2011 for their contribution which forms the bulk of the data for this study;
- the Elders, who are the custodians of the knowledge in Mqatsheni for welcoming me, a stranger, as one of their own;
- the science teachers for warmly welcoming me into the school and for their openness to discussions regarding the project; and
- Khuphuka staff for assistance with approaching Elders, with following appropriate protocols and following up on students.

Thanks also to Matt York for arranging the introductory meeting with representatives from government Departments, and for help with transport; Sister Abegail Ntleko, for accommodation and inspiration of hope to overcome challenges; everyone at Dharmagiri Retreat Centre for accommodation during many of the field visits; Ms Mavuso of Emmarentia Primary School and Dr Lawrence Molefe for checking translations. My thanks also go to RoomsForAfrica for permission to use the map of the uKhahlamba Drakensberg Park.

I am very grateful for the financial support received from

- the Aligarth Foundation;
- Oppenheimer Memorial Trust;
- TATA Africa;
- the Vice Chancellor's Office of the University of the Witwatersrand; and
- the Wits Health Sciences Research Office for the time-off to write up.

I am very grateful too to the support received through the Wits School of Education's Marang Centre for Maths and Science Education for the PhD Weekends. Colleagues, Eunice Nyamupangedengu, Audrey Msimanga and Dale Taylor gave very helpful feedback which strengthened my writing.

My praying friends, Beverley Waugh and Lorna Hill were a great source of strength. I owe my husband Todd and children Unopa and Emmanuel Khupe hundreds of hours of family time that I could not afford during my PhD journey. They prayed, provided emotional support and made countless cups of tea. Many thanks too to my greater family for prayers.

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LIST OF ACRONYMS USED

CAPS	Curriculum Assessment Policy Statements
DBE	Department of Basic Education
DOE	Department of Education
FET	Further Education and Training
FGD	Focus group discussion
IK	Indigenous knowledge
IKS	Indigenous Knowledge Systems
KZN	KwaZulu-Natal
NCS	National Curriculum Statements
OBE	Outcome-Based Education
RNCS	Revised National Curriculum Statements
SAG	Subject Assessment Guidelines
TC	Traditional Council
TPR	Transformative participatory research
WMS	Western Modern Science

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OUTLINE OF THE THESIS

I have organized this thesis into three parts. Part 1 is made up of chapters 1 and 2 which serve to introduce the study. In these two chapters I introduce myself, the study and the context in which the study occurred.

In Part 2 (chapters 3, 4 and 5) I present the Literature Review, the Research Framework and the Research Design.

I present the themes that emerged from the study in answer to the research questions in Part 3 (chapters 6 and 7). In keeping with transformative participation, I include issues that the participants raised, but that may not directly answer the research questions.

I pull all parts of the thesis together in the conclusion (chapter 8). I have included in the Appendices ethics clearance documents, lists of participants' names, samples of research instruments and samples of data summaries.

A lot of the data were in isiZulu. In this thesis, I present quotes in the languages that were used by the participants, and in cases where participants spoke isiZulu, I translated the quotes for meaning into English.

In cases where I use participants' names, it is with their consent. The place names are all real.

I present the report in the first person and in the instances where I use "we", it is meant to represent the collaborative voice.

Some aspects of this study have been presented at conferences through the following reviewed papers

1. Khupe, C., Keane, M., & Cameron, A. (2012). A phenomenographic analysis of high school students' conceptions of 'respect': Implications for science teaching and learning. *XV International Symposium on Science and Technology Education (IOSTE),* Hammamet, Tunisia.

2. Khupe, C., Cameron, A. & Keane, M. (2010a). The implications of using *ubuntu* as a guiding principle for research in rural contexts. *XIV International Symposium on Science and Technology Education (IOSTE),* Bled, Slovenia. pp. 602-607.
3. Khupe, C., & Keane, M. (2010b). Celebrating the benefits of participatory research while keeping an eye on the ethical challenges. *Proceedings of the Eighteenth Annual Meeting of Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE),* University of KwaZulu-Natal. pp. 86-90.

PART ONE

CHAPTER 1: INTRODUCTION

CHAPTER 2: THE PLACE CALLED MQATSHENI

CHAPTER ONE

INTRODUCTION

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CHAPTER ONE

INTRODUCTION

> *We don't have to make a choice between being Indigenous or being educated, but we can be both.*
>
> Shawn Wilson, in Wilson & Wilson, 2013:345

1.1 Introducing Myself

I start this thesis by introducing myself (in this chapter) and introducing the context in which my study took place (chapter 2). The purpose of sharing my background and the context of this study is for the reader to understand my choices of the research framework and methods, and, why I interpret data the way I do. I identify with Mutua and Swadener (2004) in their assertion that research is not a neutral knowledge-creation exercise, but is influenced by sociocultural experiences and histories that continually shape our thinking. For this reason, I have chosen to share parts of my life and research journey, as has become common in Indigenous research studies (e.g. Mertens, Cram & Chilisa, 2013; Mutua & Swadener, 2004). Besides, reporting personal and professional information that may have affected data collection, analysis and interpretation enhances the credibility of the study (Patton, 2002).

My name is Constance Khupe. I am a Black Zimbabwean woman. I was born and grew up in the reserves[1] of Masvingo Province, where we spoke the Karanga dialect of the Shona language. I spent my childhood years with my maternal relatives. I was never viewed as an outsider in those relatives' homes. My culture then had no cousins, aunts

[1] Reserves (also known during the colonial period in Zimbabwe as the Tribal Trust Lands, and in independent Zimbabwe as Communal Areas), are rural areas where tribal peoples live, and most often, off the land.

and uncles. We had brothers, sisters, elder and younger mothers and fathers. The 'extended' family, in its modern, Western sense did not exist when I was young. Everyone was part of this large family. Neighbours who were not direct relatives always had their families traced through totems and marriages until they became related to everyone else.

My experience of school was that it was markedly different from the experience of home. School was largely voluntary in my community the 1970s. Those of us who went to school memorised the English rhymes and stories fervently, although we did not understand them. The elders in my family (and I suppose other elders, too) seemed to be aware of the lack of a contextual relevance in our education and they always reminded me to maintain *unhu* (Shona for *ubuntu*[2]), that is, the traditional cultural norms, values, beliefs, expectations and actions. I suppose this situation forced my peers and I to learn at an early age to live differently in our home and school worlds. We would, for instance, stand up (as a sign of respect) and greet the teacher or any other elders when they came into the classroom, and sat down or knelt when the same person visited us at home. I think my family's fears of my alienation from our cultural values might have intensified during my years in boarding school when I was at home for only three months in a year.

For four years I was in a Roman Catholic boarding school. The school was part of a mission station made up of a primary school and a high school, a hospital and premises for priests and nuns. Although the mission was in the middle of the village, several strands of barbed wire kept it unalloyed by village influence. The whole settlement was semi-urban: electricity and tap water; jacaranda tree-lined streets; flower gardens and a variety of sporting facilities. Even the diet was different from what we had at home. In addition, we all operated on a strict clock schedule. Bells rang to wake us up and send us to bed; to go for class and to go for meals, and even to pray. The four years in boarding school initiated my movement away from home, away from the familiar. At home my grandmother would wake me up in response to the consistent 'alarm' of the rooster or other early morning bird. Home is that part of my world where the sun, the moon, the stars, the birds and roosters told the time. It is where as a child I had sung along to the refrains that were part of grandmother's many meaning-laden folk tales. Home is where the spoken word painted pictures; created and passed on histories and preserved language. At home, a person who made reed baskets was more

[2] *Unhu/Ubuntu* means human-ness. I explain more about *ubuntu* in chapter 4 when I present my research framework.

knowledgeable than the one who could explain *how* to make a basket, and outline its uses. It was at home that I learnt to balance a clay water pot on my head, to weave grass wristlets, and to arrange and tie up a bundle of firewood for carrying homeward from the forest. At home the world was the classroom.

School was not like home. It was removed from familiar surroundings and seemed confined to rectangular buildings. I had my first encounter with the English language in such a building at the age of six. Playing was restricted in these rooms. We played only what the teachers wanted us to play, and sang what they wanted us to sing. Unsanctioned playing could result in pinching of our little ears.

Much of the knowledge I had acquired at home was neither required nor useful at school, and school was also not really useful for practical life in our villages. No wonder, sending a child to school then, was an act of faith on the part of the parents who did, and a sign of folly in the eyes of those who did not. Many of my peers did not go through primary school. My family persisted in keeping me in school in spite of much admonishing by relatives and neighbours. It was only many years later, when the influence of urban life began to be felt in the villages that school became important to more people. Many of our neighbours suddenly developed a new view of school as a multi-purpose key that opened doors out of the village into the cities for a perceived better life.

***

I remember very little of my primary school science save for a 7th grade lesson on *jerrymunglums*. I remember that a jerrymunglum was said to be type of a spider[3]. The lesson came back to my mind as I was writing my doctoral research proposal and I was determined to find out more on the internet. I was surprised to learn that a jerrymunglum is commonly referred to as a hunting spider or a wind spider, because of its swift movement (Larsen, n.d; Punzo, 1998). In Shona a jerrymunglum is called *dzvatsvatsva* (Mashumba, n.d), a name that also relates to speed. I then realised that I had known jerrymunglums since I was a toddler, but I had known them by a different name, from a different language. Had my teacher used Shona language to mediate our learning of jerrymunglums, or simply told us the Shona name, I would have known what we were learning about that day. Perhaps I would have understood more of that lesson and I

[3] Jerrymunglums are arachnids (Larsen, n.d.).

would probably have been more interested, and perhaps I would have remembered more. I do not blame my teacher at all, because he probably did not know the 'jerrymunglums' of the textbook – he probably knew real life jerrymunglums, which can be called by different local names.

***

I trained as a teacher, after four years of secondary school. I taught at a school in a growth point. 'Growth point' is a Zimbabwean term for rural business centres that were upgraded to urban status as a way of promoting decentralisation of social and administrative services to rural areas. Growth points were therefore a kind of intersection of urban and rural life. There I experienced cultural confusion. Simple things like greetings became major decision-making issues. For instance, should I greet all people that I meet in the streets (a rural sign of *unhu/ubuntu*) or should I just pass and mind my own business (urban/Western style)? I was not even certain anymore that the people wanted to be greeted.

I studied for my first degree as part of in-service education, so I was a few years older than most of the undergraduate students. These young women and men divided themselves into two camps: "maNozi" (those who tried to speak English like first language speakers – literally, through the nose), and "maVSRB" – those with a Very Strong Rural Background. I was in the latter group and I did not try to hide it. There were strengths in that rural background: the strong sense of community and respect for age and seniority. The value system was stronger for VSRBs, and it was a strong defence mechanism against harsh urban and university life.

***

When I was growing up elders used to make generally accurate short-term predictions of the weather. They knew from wind directions when it was likely to rain and with what intensity, and when drizzle conditions were likely to be experienced. They could tell from very distant lighting flashes the likelihood of their areas receiving rainfall. The repeated passing of such comments on the weather and other natural phenomena helped to put us children in the picture, and as we grew up we were also able to make relatively accurate weather predictions. Room for this unwritten form of knowledge has not been found in science learning. I regret not only my school years when this knowledge was not used as a foundation on which to build new knowledge, but my years of high school teaching and teacher education, when I did not assist my own students to deal with

differences between their home and school knowledge. It is from this background that I sought to discover how Indigenous knowledge (IK) could be integrated in school science. The two are underpinned by different worldviews (Aikenhead, 1996), and finding ways of bringing them together in the science classroom could result in greater relevance of schooling for Indigenous students. For me, exposure to traditional African and modern knowledges has not been damaging, but has been a springboard from which I have been able to reach new heights. I value my African identity and African education. I do not regret the opportunity for a Western education. It has widened my knowledge horizon.

1.2 The South African Context

> *Education, training and innovation are central to South Africa's long term development. They are the core elements in eliminating poverty and reducing inequality, and the foundations of an equal society. Education empowers people to define their identity, take control of their lives, raise healthy families, take part confidently in developing a just society, and play an effective role in the politics and governance of their communities.*
>
> *(National Planning Commission, 2011, p. 261)*

I moved to South Africa in 2008, the year when the first class of the post-apartheid curriculum was in their last year of school. South African teachers were still grappling with changes related to the new Outcomes-Based Education (OBE) that came with democracy in 1994[4]. Education in South Africa prior to 1994 was used as a means to achieve segregation, privileging a minority of the population in both economic and worldview hegemony (Christie & Collins, 1982). With the attainment of democracy, educational reform was aimed at getting rid of both apartheid content and method. The aims and principles of the new curricula (the Revised National Curriculum Statement Grades R-9 and, the National Curriculum Statement Grades 10-12 (General) were aligned to those of the national constitution, which include the establishment of human rights, inclusivity, environmental and social justice and valuing of Indigenous knowledge systems (Department of Education, 2003). The curricula are also sensitive to issues of diversity, through the acknowledgement of the existence of many knowledge systems.

[4] 1994 marked the end of legislated segregation (apartheid) in South Africa. Prior to 1994, education had been used as an instrument to effect segregation.

Three major curriculum revisions have been made since 1994. The first was introduced in 1997, and was known as Curriculum 2005. Revisions to Curriculum 2005 produced the Revised National Curriculum Statements (RNCS) for Grades 0 - 9 and National Curriculum Statements (NCS) for Grades 10 – 12, in 2000. The latest revision resulted in the Curriculum and Assessment Policy Statements (CAPS), introduced in 2011. In all three post-apartheid curriculum documents, Indigenous Knowledge Systems (IKS) were included in the underpinning principles. The curriculum documents underscore the valuing of IKS, and science subject statements of the NCS include IKS and worldview in their learning outcomes.

Calls for the inclusion of Indigenous knowledge in school curricula are not peculiar to South Africa. In many countries where knowledge systems were subjugated and displaced by colonial authorities, calls have been made for education to be sensitive to and inclusive of the different knowledge systems, and curricula have been designed that acknowledge knowledge perspectives and languages of Indigenous peoples (Aikenhead, 2001; McKinley 2005). As a result, IK-science integration has grown to become a significant field of study in science education, especially in Australia, Canada, New Zealand, the United States of America, and also in South Africa. The premises for calls for the inclusion of IKS in school curricula are based on democratic and social justice principles, and represent efforts to recognise knowledge systems that were ignored during colonial days. Modern school-based education is strongly aligned to Western culture, as experienced after the Industrial Revolution. Science teaching is thus sometimes viewed as culture transmission and learning as culture acquisition (Aikenhead, 1996). Studies have shown that students coming from non-Western backgrounds usually struggle to learn science meaningfully, and they sometimes have to suppress their own ways of thinking in order to be consistent with science (Aikenhead & Elliott, 2010; Cameron, 2010; 2007).

In the South African context, the introduction of Outcomes-Based Education and subsequent revisions (the NCS and RNCS), represented a shift from the traditional view of a school subject as a specific and static body of academic knowledge with rigid boundaries, to a position where subject boundaries were seen as “blurred” (DOE, 2003 pp6). This shift in views on the content of subject disciplines opened up spaces for knowledge systems that were hitherto excluded from the formal curriculum. The inclusion of science-related IKS in the sciences curriculum statements was meant to expose learners to different worldviews, allowing them to appreciate, compare and evaluate different scientific perspectives (DOE, 2003). Learning Outcome (LO) 3

specifically addresses the issue of IKS, while the notes on Learning Outcome 2 make reference to learners' previous experiences and prior learning. In this respect Learning Outcome 2 can also be interpreted as promoting the inclusion of IKS, in the context of learners operating within traditional societies. The NCS (Life Sciences) notes on LO 3 express the need for the rediscovery of Indigenous knowledge "for its value in the present day" (DOE, 2003, p. 12), thereby raising "learners' awareness of the existence of different viewpoints in a multicultural society, and encourage open-mindedness towards all viewpoints" (pp13). The openness of the NCS Life Sciences and Physical Sciences curricula to IKS has not been supported through assessment (Gundry & Cameron, 2008); hence there has been little IK-science integration at classroom level.

The new CAPS documents (Department of Basic Education, 2011), have significantly shifted away from OBE. Subject boundaries are no longer "blurred", but rather clearly defined, with week-by-week teaching plans. There is less room for teacher creativity and possibly even more constricted space for integration with Indigenous knowledge.

1.3 My Own Study

My study has been part of a bigger study on Indigenous Knowledge, Science Curriculum and Development[5]. It (my study) involved collaborative engagement with Mqatsheni community in rural KwaZulu-Natal, in South Africa, in order to explore the knowledge and worldviews of the community. Identifying and understanding the knowledge in Mqatsheni, and the worldview underpinning it formed a basis for consideration of what aspects of the knowledge could be used in science teaching and learning, and how.

Participants were from the community around a high school in Mqatsheni. High school students, community Elders and teachers (including the principal) participated in the study. All community participants are first language isiZulu speakers. I am a fifth language isiZulu speaker. The fieldwork involved 10 visits, each one week long, and spread over a two-year period from August 2009 to July 2011(Appendix 1). Between visits, I maintained communication with community participants through phone calls, both to follow up on agreed tasks and to keep relationships going. Continuing contact was also facilitated through a number of site visits by the leader of the bigger project.

[5] The broader study was led by Dr Moyra Keane and involved partnering with communities in identifying ways of bringing together Indigenous knowledge and science in ways that would benefit participants.

The influence of cultural backgrounds (including religion) on science education has been widely researched, both in South Africa (e.g. Cameron, 2010; 2007; Lawrenz & Gray, 1995; Manzini, 2006) and elsewhere in the world (e.g. Aikenhead, 1996; Bang & Medin, 2010; Barnhardt & Kawagley, 2005; George, 2013; 1999). Western Modern Science (WMS), on which school science is based, is a culture in its own right, with its own language, habits and values (Aikenhead, 1997; 1996; Jegede, 1995). My study is therefore located within the field of multiculturalism and science education. Studies in multiculturalism in science education point to difficulties that students face in negotiating boundaries between their culture and the subculture of Western science, on which school science is based (Cameron, 2007; Jegede, 1995). Science teaching that acknowledges students' knowledge and culturally-based ways of thinking has potential to make science more meaningful to students. In South Africa there is more research into multicultural science education in higher education institutions than there is in communities and schools.

1.3.1 The problem

The recognition of Indigenous knowledges in education represents an acknowledgement of diversity in accordance with the South African constitution. However, numerous challenges militate against classroom implementation (Naidoo, 2007). These challenges originate from different sources. The first challenge is that the integration of Indigenous knowledge and school science places side-by-side two radically different knowledge systems originating in different underlying assumptions (Ogunniyi, 2004). On the one hand is school science, which originates in a culture of written knowledge, and is therefore more clearly structured for teaching and learning. 'Experts' in science education are involved in the development of national curriculum documents, textbooks and even online resources. Because of the long tradition of school science content that is fairly consistent across schools and even across countries, it is easier to 'package' for teaching. Indigenous knowledge, on the other hand, originates in oral cultures and abides in the hearts and minds of Elders and specialists knowledge keepers in particular areas. Those who possess the knowledge do not necessarily look to publishing it. In many cases the knowledge is regarded as a heritage to be passed on for practical and survival purposes. In addition, Indigenous knowledge is a way of living in nature (Aikenhead, 1996) and is not easily amenable to categorisation. This makes it more difficult to break down for classroom teaching and learning. Besides, some IK is secret and what is known to particular individuals and

groups is sometimes not meant for the public domain, and hence not easily accessible for classroom teaching and learning. Also, it is not in the nature of Indigenous knowledge to seek universal application, because of its strong connection with place. Different communities can therefore have different knowledge, and this makes standardisation of content for teaching difficult. Recognising these differences is critical to successful integration of IK and school science.

A second challenge facing IK-science integration has to do with prejudice against IK by some teachers, learners, and researchers. Fuelling such prejudice is the long history of the dominance of Western science over other ways of knowing, and this dominance has left little room for knowledge diversity. There are debates on whether IK constitutes authentic knowledge, let alone authentic science (Horsthemke, 2004). Besides, the teachers themselves learnt science in a 'Western' knowledge framework, hence understand very little about IK (Moyo, 2011; Ogunniyi, 2004). Questions have also been raised as to whether IK is really desired for inclusion in the curriculum in given communities (Horsthemke & Schafer, 2007). Understanding the nature of IK and the nature of science and learning is therefore an important step towards IK-science integration (Ogunniyi 2004).

A third challenge is that there are hardly any noticeable practical steps taken by the Department of Basic Education[6] regarding IK-science integration. Implementation has been left up to the teachers (Moyo, 2011). The conspicuous absence of IK-related assessment undermines the position of IK as an underpinning principle of the curriculum (Gundry & Cameron, 2008). Besides, in a sudden turn of events, the Physical Sciences CAPS document makes no mention of IK beyond the underpinning principles in the introduction (DBE, 2011), a development that may lead to teacher and researcher uncertainty about the future of IK in school science.

Lastly, South African teachers have been inundated with frequent curriculum changes, and are likely to have problems coping with all of them. The valuing and inclusion of IK is probably one of the 'smaller' curriculum changes that teachers can afford to ignore, especially when exams over the years have not singled it out as important.

The challenges outlined here reduce the practical inclusion and valuing of IK in the classroom to a policy ideal with little expectation of practical integration. A gap therefore

[6] Formerly the Department of Education.

exists between the curriculum intentions involving Indigenous knowledge, on the one hand, and the implementations of those intentions in the classroom, on the other. That gap could be narrowed by research focused on understanding the knowledge and worldviews of given communities. My study is based on the contention that narrow community-centred research on Indigenous knowledge may lead to greater valuing of IK, and greater possibilities of useful classroom inclusion which would be more effective than declarations in national documents. It is from such research that teachers could make curriculum decisions on locally-compatible ways of bringing Indigenous knowledge into science teaching and learning at classroom level.

1.3.2 Purpose of the study

The purpose of my research study was to explore and document, from interaction with the people of Mqatsheni, their 'Indigenous' knowledge, and the worldview underpinning their knowledge and practices, for use in science learning. My research intentions were three-fold. The first was to identify, through collaboration with the community, the Indigenous knowledge and practices that 'define' the people of Mqatsheni, and thus gain an understanding of their worldview. In this way, the study would not only create opportunity for Mqatsheni community to make their knowledge available for use in school science, but would also contribute to documentation of Indigenous knowledge as purposed by the Department of Science and Science and Technology (Mosimege, 2005). The second intention was to create a repository of ways in which IK in Mqatsheni could be used in science teaching, thus contributing to a culturally relevant curriculum (Aikenhead and Elliott, 2010; Sutherland & Swayze, 2012) and culturally relevant pedagogy (Ladson-Billings, 1995a; 1995b), which could be more aligned to the participants' worldview. The last was for the research to contribute to transformation in Indigenous knowledge research by following methods that recognised Indigenous knowledges, practices and languages as valuable (Chilisa, 2012; Odora Hoppers, 2002a; 2002b; Smith, 1999). This could have the long-term effect of strengthening Indigenous identities and participation in local communities, as well as greater respect for local Elders (Brayboy and Castagno, 2008).

1.3.3 Research questions

My study intended to answer the following questions:

1. What Indigenous knowledge can be identified from interaction with participants in Mqatsheni?
2. What constitutes the worldview that informs the community's Indigenous knowledge?

3. What aspects of the participants' knowledge could be included in school science, and how?

As these questions were set before engagement with the community, they are from my perspective, and are not necessarily the same questions the community participants would have prioritised. I was aware of this dilemma as I was formulating these questions. However, since the study was one in which relationship building and collaboration were important, we all proceeded trying to find answers to these questions, aware of the constraints of the research process but also open to guidance and input from the community.

1.3.4 The knowledge gap

A number of studies in the field of Indigenous knowledge and science education have been carried out in the South African context. Keane (2006a) focused on science and research in a rural context, and found that for rural communities, relevant science was not separable from the community's knowledge and worldview, and that relevance was linked to the people's survival. Manzini (2006) and Cameron (2007) studied how non-Western students learnt science, at secondary and tertiary levels respectively. Both studies revealed the influence of students' cultural backgrounds in science learning, thus confirming the need for cultural brokering in science teaching. Ogunniyi has done much research focusing on the use of argumentation in integrating Indigenous knowledge and school science. Much of Ogunniyi's work is with in-service teachers enrolled in postgraduate programmes (Hewson & Ogunniyi, 2011; Mushayikwa & Ogunniyi, 2011; Ogunniyi, 2007a; 2007b; 2004). Findings from Ogunniyi's studies show that the Contiguity Argumentation Theory (CAT) is useful in facilitating the integration of IK and school science.

These South African studies have been instructive in identifying gaps in IK-science education research, particularly with regards to the school context. Many studies have focused on singular aspects of IK-Science integration. Examples include focusing on identifying science-like IK (Moyo, 2011); teachers' attitudes in implementing IK-science curricula (e.g. Moyo, 2011); and challenges in implementing IK-science integration (e.g. Ogunniyi & Ogawa, 2008). The relevance of these studies cannot be questioned. In a more recent study, Webb (2013) uses a multiple source survey and follow up interviews to identify aspects of Xhosa Indigenous knowledge that the participants valued and thought should be integrated in school science. Findings from Webb's study reveal a lack of consensus in communities on the position of IK and school science. Webb thus

suggests that “more critical reflection on the why, what, whether, when, where and how of reconciling differing worldviews in science classrooms may be required” (Webb, 2013:107). Webb’s recommendation is most enlightening, considering that 16 years after the introduction of IK in science the basic questions of *why, what, whether, when, where* and *how* are still to be answered.

As far as I have established, South African studies on IK-science education have not focused on identifying IK from a systemic perspective - that is, Indigenous knowledge systems (IKS) and finding ways of integrating the IKS with school science. A community-based study could lead to the recognition of such IKS, and could be drawn on in science teaching and learning. Applying the IKS in classroom practice could make local level science education relevant to students’ experiences, and that could raise students’ interest in school science. Moreover, a community-based study also has potential to support the creation of a place-based repository of Indigenous knowledge for use in the classroom. My study has the potential to fill that gap.

1.3.5 Rationale

My contribution to science education research through this study is two-pronged. The first is with regards greater recognition of IK in science education, and the second regards the importance of appropriate methodologies for IK-science education research.

Improved science teaching and learning

Making science attractive and accessible to students is a major focus of science education (George, 2013). The inclusion of IK in science teaching and learning contributes to this goal through being attentive to relevance and sensitivity to students’ cultural contexts (Webb, 2013). The inclusion of IK in science learning is consistent with constructivism and learner-centredness (Malcolm & Keane, 2001). Science teaching that acknowledges and values students’ Indigenous knowledge has been seen to increase their interest and participation (Brown, Muzirambi & Pabale, 2006) and could lead to more personalised and relevant learning (Keane, 2006; Webb, 2013). When students meaningfully engage with science learning, we can expect better educational outcomes (Aikenhead & Elliott, 2010), which could have long-term benefits for both individuals and societies.

Both local and international research reports low achievement in science subjects by non-Western students (Cameron, 2007; Naidoo & Lewin, 1998; Aikenhead, 2006a;

2006b; Sutherland & Dennick, 2002). In South Africa, Blacks form the majority of the student population, and 54% of the total student population live in rural areas (Children's Institute, 2012). International trend data from such sources as Trends in Mathematics and Science Study (TIMSS) point to the general inequity in achievement between students in rural areas and those in non-rural areas, and how the difference increases with distance from the metropolitan areas (Pegg, 2009). Ogunniyi (2004) highlights the importance of teachers' understanding of their learners' worldviews as contributing to their (teachers') understanding their students' learning methods. Through investigating learner worldviews, my study contributes to greater awareness of student learning methods by the teachers, thereby contributing to improved interest and improved learner performance in school science.

Aligning methodologies

The academic world accords respect to 'experts'. The curriculum is designed by 'experts'. Researchers are 'experts' in their fields. News broadcasts include the opinions of economists, political analysts, educationists, and scientists, on matters of public concern. In beginning this study, I was neither an expert in research nor in Indigenous knowledge. I sought to learn from the experts. In matters concerning IK, community participants are the experts. It is the Elders who have custody of this knowledge. The young people come to know with age and experience. It is the perspective of the community members who participated in this study that I highlight in this research report. A considerable number of South African studies in IK and science education have focused on teachers' perspectives and experiences of IK (e.g. Ogunniyi, 2007; 2004; Moyo, 2011). However, teachers are sometimes not acquainted with IK enough to identify what to include in science learning (Moyo, 2011). Therefore, in this study the central characters are the community Elders (mainly represented by the Traditional Council), and the youth (represented by Grade 10 -11 students). These participants are the ones who directly live out and experience Indigenous knowledge. They are the experts. It is their perspectives and their 'voices' that need to be heard in matters relating to IK and science. Using focus group discussions and interviews (with Elders) and whole class discussions, free writing, working with photographs and playing games (with students), I drew on the participants' experiences to create understandings of the knowledge in Mqatsheni and the worldview underpinning it. I drew from these various activities to come to an understanding of what could be integrated with science and how.

1.4 Language

The community participants were isiZulu speakers, but they were at liberty to communicate in either isiZulu or in English. The Elders spoke in isiZulu in all discussions and the students used both languages. In this thesis, I present data in the language used by the participants. Where quotes are in isiZulu, I explain them in English in order to make them understandable to non-Zulu readers.

1.5 Ethical Issues

Before undertaking this study, I sought and was granted ethical clearance in line with the requirements of the University of the Witwatersrand's Human Research Ethics Committee (Non-Medical), Protocol number H09/04/10A (Appendix 2). I sought and received permission from the KwaZulu-Natal Department of Education (Appendix 3). In the field, I invited participation through first explaining the purposes of the study in either isiZulu or in English, depending on the language that the potential participants were more comfortable to speak (see Participant Information Sheet, Appendix 4). Those who chose to participate did so on voluntary basis. I sought the assent of students, and in addition, the consent of the school principal, teachers and parents for those students to participate in this study. Adult participants also signed consent forms for their own participation (Appendix 5). During the course of the study, it was necessary to make verbal requests to take photographs, and make audio and video recordings, as a way of ensuring that everyone was comfortable to have these recordings made. In all instances, the participants consented to these activities. I sought participants consent for the use of photographs and the use of actual names in the research report, and they consented to this (see Appendix 5).

In this study, I acknowledge the role played by all community participants in choosing to share their knowledge, not just with me, but with the global community through this thesis and other papers. The knowledge that I discuss here is what we collaboratively created during the study. Therefore, it is ethically appropriate, and it is consistent with the research purposes, to acknowledge the contribution of the community participants (listed in Appendix 6 and Appendix 7) by including their names.

1.6 Definition of Terms

In this thesis, I have used many terms that could have different meanings in other contexts, or, could be written differently. Therefore, I explain below the meanings these terms are meant to convey in this study, or the way I decided to write them in this thesis.

Black and/or White I use these terms for identification only, and not in the segregatory way in which they were used in apartheid South Africa. These terms are commonly used in South African documents for the purposes of recording demographic information.

Elders: In this study, I use the term 'Elders' to refer to elderly members of Mqatsheni community and members of the community traditional leadership (the Traditional Council). I write this term beginning with a capital letter throughout this report.

Indigenous: I write the term beginning with a capital letter to represent its reference to people, as used in Battiste (2005). The same applies in the reference to the terms **Western** and **non-Western**. Where I use the negatives with reference to people, as in, for instance, 'non-Western', it is for identification only, and is not intended to demean any people.

Indigenous knowledge (IK): specific forms of knowledge that is local and specific to place. In languages where verbs are more central than nouns, Indigenous knowledge could be synonymous to 'ways of knowing'.

Indigenous Knowledge Systems (IKS): the totality of the knowledge that a community holds. IKS includes worldview, and is therefore broader than IK.

School science: Life Sciences and Physical Sciences as defined in Further Education and Training (FET) Phase in curriculum documents for South African schools.

Western (also Eurocentric) science: knowledge accumulated over many centuries from both European and non-European cultures and has been modified to better fit the ways of knowing of Western science.

Worldview: a person's thinking and understanding and the world and their being in the world. The values that a person holds often result from their worldview.

CHAPTER TWO

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CHAPTER TWO

THE PLACE CALLED MQATSHENI

When I heard Mqatsheni had very cold winters and sometimes even had snow, I was really excited and greatly looked forward to my first visit, desperately hoping there would be snow. I started creating mental images of myself in snow. My family shared in the wild excitement.

On arrival in Mqatsheni, I learnt that the community had been devastated by strong winds which left a number of families with literally no roofs above their heads. The occupants were left in the cold. As we chatted about this disaster with Skhumbuzo (who had agreed to participate in the study as a research assistant), he remarked, "This place is always facing one weather disaster or another. It's the strong winds, heavy rain or snow". That was a sobering moment. I suddenly realised I had not, for one moment, stopped to think of how the weather impacted the community. I regretted my naïve, 'tourist' attitude, and was grateful I had not mentioned to Skhumbuzo how desperately I had wanted to see snow.

Reflections on first visit to Mqatsheni (August 2009)

2.1 Introduction

My study is a site of struggle between researching in one paradigm (Indigenous research, described in chapter 4) and reporting in a way that meets the demands of a mainstream research study. My second chapter comes as another description – this time setting the scene with the background to my research context. In presenting this context, I intend to guide 'outsiders' to this study to a deeper understanding of the participants' experiences and perspectives. I position the chapter as a window through which the outside world can appreciate what is happening in Mqatsheni. I was an outsider in Mqatsheni myself, and I had to come to understand the context myself, for

me to appropriately relate to the community (Vakalahi & Taiapa, 2013). My effort to understand life in Mqatsheni was a process rather than an event, stretching well into the data collection stages. For this reason, I make reference to data in explaining the context.

Understanding the situation in Mqatsheni helped to clear many of my assumptions, misconceptions and stereotypes, and facilitated respectful relationships as well as better understanding of the data. It is with this reasoning that I present this chapter. I have divided the chapter into seven sections. Each of the sections (except the introduction and the summary) focuses on an aspect of the realities of life in Mqatsheni.

2.2 The Geography of Mqatsheni

Mqatsheni is one of five rural settlements in KwaSani Municipality, Sisonke District in KwaZulu-Natal Province. The village is located in the southern Drakensberg about 30 kilometres north of Underberg, the commercial centre of KwaSani. The area is home to just over 3,300 people (KwaSani Municipality, 2012). Mqatsheni shares space with commercial plantations, the dominant agricultural activity in the area. The village offers little of economic importance to the outside world; hence it is largely unknown outside of KwaSani. Mqatsheni occupies the lower parts of the Drakensberg and thus it not only shares the beauty of the mountain landscape (Figure 2.1), but also suffers the extreme weather conditions of strong winds, heavy rains and snow.



Figure 2.1: A view of uKhahlamba Mountains from Mqatsheni valley

Mqatsheni is connected to the more economically important parts of South Africa via the small town of Underberg. From Underberg, the surfaced road proceeds to Sani Pass and a dirt road winds itself around the many hills. During the dry months, the passage of each motor vehicle is marked by clouds of dust, which for some moments reduce visibility to only a few metres. Huge trucks belonging to plantation companies are the main road users and their speed seems to signify that the road belongs to them. Public taxi-minibuses also speedily negotiate the sharp bends and steep slopes, seemingly oblivious of the dangers therein. During the dry months the dust settles on anything in its way. The grass, shrubs and trees along the road lose their colour and all adopt a khaki hue. When you walk on the road sides, you plod into the powder and it flies up your legs. Once in a while, a truck with a bowser sprinkles water on the road as it goes. Once the rain comes, it cleans the dust away and leaves the vegetation in a cheerful green.

The road that runs through Mqatsheni offers a good vantage point for one to have a view of the surrounding landscape. Homesteads are scattered all over the hill slopes, down to the valley below. Views from higher up the slopes overlooking the Mqatsheni River valley give the impression of aerial photographs. Some slopes are completely covered in bush, mostly wattle, which has ‘colonised’ the local ecosystem. Patches of red earth are testimony to the effect of heavy rains, made worse by grazing on steep gradients.

As mentioned earlier, plantation agriculture is the major form of commercial farming in Mqatsheni. All the year round there is activity on these farms: felling, burning, planting and other related activities. When a portion of the plantation has been harvested, women from the village usually go and 'glean' unwanted logs for firewood. There is no electricity in Mqatsheni.

At the time of my first entry into Mqatsheni, the village was alive with construction activity. Each homestead was going to benefit from the construction of a 'modern' house, through the government's Reconstruction and Development Programme (RDP). The new houses were to be constructed at every homestead, irrespective of how many huts (rondavels) and houses the homes already had. Many of these traditional rondavels are skilfully constructed and are very beautiful. Many of these huts have withstood the strong winds common to Mqatsheni, and which only a few days before my first visit had blown off the roofs of the newly completed 'modern' houses.

2.3 Language

The language of communication in Mqatsheni is isiZulu. English is the language of instruction in the participating school, but it is not often spoken outside of school. Sometimes isiZulu is used during science teaching and learning. My experience of the students' spoken and written language is that they express themselves in very rich Zulu and often use metaphors:

> *Ngifuna ukuba nekusasa eliqhakazile.* (Kholeka, My Future, 2009). {I wish my future to blossom}

The students hardly ever mixed isiZulu with English or other languages.

The role of language in thought (Vygotsky, 1978) and in relationships (Odora Hoppers, 2005) makes it an important aspect of educational research, especially in rural contexts. While English may be the 'gateway' to the world outside Mqatsheni, isiZulu underpins the participants' identity. IsiZulu is not just the name of a language. IsiZulu is about culture, as driven by language. The Zulu culture and knowledge are best understood through Zulu language.

From the beginning of the study I undertook to communicate in isiZulu as much as was possible. I understood that language influences the research process in more ways than

one. Using isiZulu as the 'language of the study' had ethical significance. As a university researcher I had the responsibility to effectively communicate the project purposes and expectations. I had information for participants and consent forms in both isiZulu and English. I also explained the contents of the same documents in isiZulu for enhanced clarity, and to ensure participants made informed choices. I avoided using language that would give an impression of being overbearing and disrespectful. In being consistent with research in a village context, establishing and maintaining good relationships was a key ingredient for the success of the study. Communicating in isiZulu was thus a first step of showing recognition and value to both isiZulu language and the Zulu people.

Communicating in isiZulu had the potential benefit of generating rich data resulting from the possible sense of security for participants speaking their own language, and feeling less vulnerable to saying what they do not mean to. Besides, language is an integral part of Indigenous knowledge systems, (Barnhardt & Kawagley, 2005); hence the decision to communicate with participants in isiZulu was consistent with the research questions.

2.4 Distance

Distance is one of the characteristics that distinguish rural from urban areas. Residents of rural areas continually have to negotiate distances to schools, clinics, to sources of water and firewood. Distance is one of the factors that discourages many people from living, working and doing research in rural contexts.

The participating school (Figure 2.2) is the only high school in Mqatsheni, serving four primary schools[7]. It is a functional[8] school. Teachers and students are usually at school and in class. On average, the school achieves above 80% pass rate in the Senior Certificate examinations. Some students walk more than 10km to and from school every day. The school has just over 300 students, 12 teachers, an administrative secretary and a security guard. Some among the teachers are local residents. Others rent a room in the village during the week and travel to their own homes during weekends, and yet others commute 30 kilometres from Underberg (an hour-long journey on the potholed dirt road).

[7] The situation of one high school serving four primary schools is possibly the result of high dropout rates even at primary school level.

[8] An estimated eighty per cent of South Africa's schools are considered dysfunctional and inefficient, and learner performance at all levels is largely below the expected curriculum outcomes (Taylor, Mabogoane & Akoobhai 2011)



Figure 2.2 The participating school

By way of facilities, the school has three classroom blocks, enough furniture for all learners, one computer, printer and a photocopier, all meant to be powered by solar energy. The solar equipment was not working for the duration of this study. Rain-water harvest tanks supply drinking water to the school. For sanitation, the school has a block of pit toilets.

During the rainy season rivers are sometimes flooded and students cannot cross them to get to school. School becomes inaccessible until the floods subside. During this time the dirt road to Mqatsheni also becomes too soaked and slippery even for motor vehicles meant for difficult terrain. Staff members who commute from Underberg then cannot get to school. Mqatsheni is frequently cut off from the rest of the world by extreme weather conditions.

As a result of little access to educational resources, the students' expressed educational needs are quite basic, and include things that their counterparts in differently resourced environments would probably take for granted, for instance, completing their present grade; speaking English and reading a newspaper.

For many services, the people of Mqatsheni have to travel to Underberg and Himeville. Health is one of them. The community constantly deals with sickness and death. For the past three decades, Mqatsheni has had to care for an ever-increasing number of orphans, a task that has been overwhelming for many families (Ntleko, 2012). Students'

visions about the future highlight health and welfare issues, particularly the issue of orphans:

> I want to be a Social worker because I like to help the orphans that are homeless. I want to build a shelter for them. I am also an orphan (Lindiwe).
>
> *Ngifuna ukuba yiSocial Worker ngisize abantu abanezinkinga, njengezingane ezingenabazali, ukuze ngikwazi ukubaxhumanisa nabezenhlalakahle ukuze bathole usizo* (Xolisile).
> {I want to be a Social Worker so that I can help people in difficult circumstances, such as children who do not have parents. I want to connect them to [the Department of] Social Development so they can get help}
>
> *Ngifisa ukuba umhlengikazi khona ngizosiza iziguli, ngisize laba abathintekile ngale sifo sengculazi negciwane laso. Ngizophinda ngixwayise izingane ezingazi ngobubi baso lesi sifo sombulalazwe* (Happiness).
> {I would like to be a nurse so that I will be able to help the sick and those affected by AIDS and HIV. I will advise the youth about the dangers of this plague}
>
> *Ngifisa ukusiza ikakhulukazi lezi zingane ezingenabo abazali, ezihlala ngazodwana emakhaya azo eziyizintandane* (Bonakele).
> {I would especially like to help those children who do not have parents – those children who live on their own, the orphans}
> (My Future, 2009, 2011).

The students' wishes give an insight into the desperate basic needs of the community. Khuphuka (see site photograph, Figure 2.3), a Non-Governmental Organisation, has assisted the community of Mqatsheni in the area of HIV/AIDS education, community support and care, testing and counselling. Khuphuka's work has expanded to helping community members get identity documents for access to social grants.



Figure 2.3: Initial developments at the Khuphuka site in 2010.

My entry into Mqatsheni was facilitated through Khuphuka, and throughout the study, relationships with the Khuphuka personnel have been rewarding, particularly in terms of negotiating access into Mqatsheni. Skhumbuzo and Vincent (Figure 2.4), both staff members at Khuphuka, volunteered their assistance during the study. They approached Elders, helped with translations, and worked with the students.



Figure 2.4: Constance (centre) and research assistants

2.5. Changing Contexts: For Better and Yet, For Worse

Some of the Elders in the study were born before the formal institution of apartheid in 1948, and lived through the apartheid years, to the present – spanning three major political eras. These political changes are likely to have impacted the community in different ways, but none of them seems to have significantly improved the standard of life in Mqatsheni. The residents cannot adequately fend for themselves, so the majority depend on social grants:

> *Uma kufanele sikhulume iqiniso, indawo yakithi iphila ngempentsheni. Uma kufa isalukazi, asikhali ngoba sikhalela ukuthi kufe ugogo. Sikhala ngoba sikhalela ukuthi kuphelile ukudla kulowo muzi. Kuphelile ukuphila kulowo muzi* (Ms Majozi, FGD May 12, 2010).
> {If we are to tell the truth, our place survives on pensions. When an old woman dies, we do not mourn because we have lost a grandmother. We mourn that there is no more food in that household. There is no more life in that household}.

Some transformation efforts that came with democracy seem to have brought much tension in Mqatsheni, disrupting culturally instituted power relations and family order. Elders express disappointment with some of the changes that were introduced by the democratic government. For instance, some sections of South Africa's globally-renowned constitution are not well received by the older population. The Constitution is founded on, among other values, "human dignity, the achievement of equality and the advancement of human rights and freedoms" (The Constitution of the Republic of South Africa, Chapter 1, Paragraph 1 (a)). These founding values are intended to address the injustices of South Africa's past, where ethnicity determined the level of human dignity, rights and freedoms. The values are not interpreted in the same way in Mqatsheni. One source of dispute is the issue of child discipline. The South African Constitution provides for every child to be "protected from maltreatment, neglect, abuse or degradation" (Chapter 2, Paragraph 28 (1) (d)), a position that outlaws physical punishment. In contrast, the male Elders believed in child discipline based on force as a necessary condition for bringing up respectful and respectable children. They think that children's rights and women's rights were 'foreign' concepts which have done more harm than good:

Elder 1[9]: *Thina sikhule sishaywa noma ngubani...Uhulumeni usethe "izingane mazingathinthwa". Yinkolo yethu thina bantu, siyashaywa. Azisashaywa-ke manje. Izingane zanamhlanje zenza noma yikuphi: abafana bakhulelisa laphayana, amantombazane labo bayakhulelwa laphayana! Ngeke uyithinte ngoba uhulumeni uthi mazingathintwa ngesandla.*

{When we grew up we could be punished[10] by anyone…Now the government says "no one must lay a hand on children". [But] that is what we believe in. We are [continually] punished. They [children] are now not to be punished. Today's children have no boundaries: the boys are busy making girls pregnant here, and the girls are also busy getting pregnant there! You cannot lay a hand on them because the government says you may not}.

Elder 2: *Kuthi nelungelo - ingane nonkosikazi sebenelungelo!* {And rights - the child and the woman now have rights!}

Elder 1: *Lana kaMaguzwana uhulumeni akasizi nakancane nje!* {Here in Maguzwana the government is not helpful at all!}

(FGD October 26, 2010).

The concept of human rights brought with it women's rights and children's rights, which some Elders see as inconsistent with traditional Zulu values. For this reason, they declare that the government is not helpful to their community. The 'help' referred to here is perhaps more cultural than economic. Democracy brought concepts that are foreign to the people of Mqatsheni and has resulted in a disrupted social and cultural order:

Uhulumeni usuke wangena kakhulu ebantwini kwavela igama lokuhlukunyezwa. Asilazi thina. Ingane ithi uyayihlukumeza! Kuthiwa ihleli ngokuhlukumezeka, into esingayazi, ngoba ingane yinto ethethiswayo neshaywayo. Ehhe, nefundiswayo phela ukuthi ifanele iziphathe kanjani. Makuthiwa iyahlukumezeka akusazeki manje ukuthi kuzokwakhekani/…/usekusuke uhulumeni wangena kakhulu ebantwini. Wafaka leya mfundiso yakhe esingayazi ukuthi ivela ngalaphi. Ethi ingane uma uyiyala kuthiwa uyayihlukumeza. Angikwazi-ke ukuthi kungenzeka njani-ke lapho (Elder 3, Interview, May 28, 2010).

{The government has interfered too much with the affairs of the people, and came up with the word called 'abuse'. We do not know this word. A child saying you are abusing them! They [the government] say, "The child is living in an abusive environment"! This is something that we do not know about, because it is normal for a child to be admonished and beaten, and to be taught on how to behave. If then the child is said to be abused, we do not know what the outcome will be…The government has interfered too much with the

[9] I have chosen not to include the Elders' names here, so that these Elders may not be viewed in negative light by their community as well as readers from outside Mqatsheni.

[10] In this conversation and in others related to it, the Elders were talking about physical punishment.

people's lives and has planted foreign teaching whose origins we do not know – a teaching that interprets disciplining a child as abuse. We do not know what can be done}.

The democratic government and Mqatsheni Elders are operating from different epistemological positions, the former fighting for redress from a colonial legacy, and the latter fighting against cultural invasion.

The coming of the cellular phone apparently adds to Mqatsheni Elders' woes. The cell phone gives children access to social structures and services outside of the village, for instance, the Police and other child protection services. The children are encouraged to report abuse:

[inhlonipho] icashiswa-ke, uma ubheka, yiyona leya indlela yokuthi ingane yazi ukuthi izokubopha ithi uyayihlukumeza. Manje-ke, lendaba ilukhuni. Ilukhuni impela ngendlela ongasazi ukuthi ungathi kungenzeka njani kusasa. Ngoba manje uyiphethe ngala – iphethe nefoni leyo. Leyo foni uzofonela amaphoyisa (Elder 3, Interview, May 28, 2010).
{When you look at the issue closely, respect is diminishing because children know that they can have you arrested on the pretext that you are abusing them. This issue is hard, so hard that you end up not knowing what the future will be like, because while you hold their one hand, in the other the child is holding a phone and will use it to call the police}.

Democracy and modernisation thus work together, in the Elder's opinion, to undermine their authority regarding child discipline. Democracy introduced discourses hitherto unknown in the community, such as rights and abuse. The Elders suspect the influence that the government has on the children is not for the good of the children and the community. It is for political 'mileage':

Mr Myende: *Kodwa engikubonayo mina ikakhulukazi, uhulumeni ufuna ivoti.* {In my opinion, the government just wants votes[11]}.
Mr Duma: *Eyinganeni?* {From the children [youth]?}
Mr Myende: *Yingakho engenawo umthetho olungile othe ngqo!* {That is why they [the government] do not have any good and straightforward rules!}
[Other Elders nod in agreement].
Mr Myende: *Ngoba ufuna ivoti.* {Because they want votes}.
Mrs Mlibeni: *Iqiniso. Uqinisile uMyende.* {That is true. Mr Myende is telling the truth}.
Mr Myende: *Ufuna ivoti lokuthi avotelwe ukuthi u*right *noma enge*right. {They want [youth's] votes so that they are seen as right even though they are not right}.

[11] South Africa has a young population. Statistics South Africa (2013) estimates that 39.93% of the national population below the age of twenty years. The large number of youth could make the Elders' allegation plausible.

(FGD October 26, 2010).

What the Elders have not highlighted in this conversation, is the prevalence of violence against women and children, which presents a paradox when the state protects women and children more than the family and community.

Another source of conflict surrounds land use. Archaeological evidence (Wright and Mazel, 2012) suggests that San hunter-gatherers occupied the uKhahlamba region (Zulu name for the Drakensberg) about 25,000 years ago. Black farmers who spoke isiNtu languages (of which isiZulu is a part) are thought to have started occupying the lower parts of the mountains, and to have gradually moved upland in the last 1,000 years. It is thought that the San could have gradually integrated into the farming communities. Major changes in the communities' ways of life could have started when White settlers took interest in farming in the UKhahlamba region from the late 1830s, and with the establishment of the colony of Natal in 1843. The British settled several Black tribes in the foothills to shield White farmers from cattle raids by the San who still occupied the mountains (Wright and Mazel, 2012). Over the years the British farmers expanded farming activities closer and closer to the mountain, resulting in progressively less land being available to the locals. As a result, some families had to work on the farms as 'tenants' while others began to migrate to towns and cities for employment. By the 1920s, the Black population could no longer sustain rural livelihoods in the manner they had done prior to the coming of the British into the UKhahlamba area. Land shortage on Black-owned land became worse with the forced removal of former 'tenants' from White-owned farms in the 1950s into the already overcrowded 'reserves'[12].

Concerns about conservation of uKhahlamba resources are said to have started in the late 19th century. According to Wright and Mazel (2012), these conservation efforts led to the establishment of the Giant's Castle Game Reserve in 1903 and the Natal National Park in 1916. Later on the government set up more Forest Reserves where cutting down trees, hunting, and grazing of livestock was prohibited. With the growth of industry in the cities of Durban and Johannesburg in the 1930s, ideas of harnessing water supply from the uKhahlamba region emerged. About the same time, the mountain region began to attract tourists and there was even greater need to protect the natural resources. The Natal Parks, Game and Fish Preservation Board[13] was formed in 1947

[12] Areas reserved for the Black population during the colonial period.
[13] The board was later named the Natal Parks Board.

to manage existing nature reserves and establish new ones. Some of the new nature reserves had been previously occupied by Blacks. All the protected areas in this region are now jointly called the uKhahlamba Drakensberg Park (Figure 2.5). The Park was declared a world heritage site in 2000.

The effect of the Natal Parks Board (NPB) mandate to establish new nature reserves had a most devastating effect on the people of Mqatsheni. The Elders give the example of one of the chiefs who could not stand the dispossession and ended up emigrating to Lesotho in protest.

> *Indawo yakithi sibona ukuthi iyancipha ngezizathu eziningi. Esikhathini esidlulile sobandlululo yadleka ngaleso sikhathi, yanciphiseka. Okuyikho okuthe masilandela emdeni wasenkosini ukuthi yini eyasusa inkosi kule ndawo, sathola ukuthi yasuka ngesikhathi izwa ubuhlungu ngendlela akade benza ngayo befika kule ndawo, ngesikhathi sebengenelela umbutho ka N.B.P. Beqala ukungenelela bathatha namaphulazi, bethatha iyindawo. Yezwa ubuhlungu, yaduma yahamba yayohlala eLesotho* (Ms B Majozi, FDG May 12, 2010).
> {We see our place getting smaller for many reasons. Much of our land was taken during the period of segregation, which is why, as when we learn from the Chief's family, he left this place. We found out that he left as a result of emotional pain resulting from the way things happened when they (forces from N.B.P.) came to this place. They took farms; they took some of [our] places. The chief could not stand it, so he went and stayed in Lesotho}.

> *Kuqala kade uParks Board engekho. Bekuhanjwa kuzo zonke lezi zintaba, kuqoqhwe iyinkomo zihambe zifike eSani Pass. Amasela ayengekho ngoba ubusuku nemini abantu babenelungelo lokuthi bahambe* (Mrs Luswazi FDG May 12, 2010).
> {Initially Parks Board was not there. We would move around in all these mountains, herding cattle. We would go as far as Sani Pass. There were no cattle rustlers because there was free movement in the mountains[14]}.

[14] Livestock theft around the uKhahlamba mountains has been going on for more than a century. Mrs Luswazi's argument is probably that there was less cattle rustling in the past than there is now because the people had free movement in the mountains.



Figure 2.5: uKhahlamba Drakensberg Park (Courtesy: RoomsForAfrica, 2002-2013 http://www.roomsforafrica.com/dest/south-africa/kwazulu-natal/parks/drakensberg.jsp?tab=3)

The lofty status of the uKhahlamba Drakensberg Park has not brought locals much direct benefit, even in the period after 1994. If anything, the Park has added to their misery and poverty. The people are denied access to the mountains and tourism is run mostly by White-owned companies with no local entrepreneurism. The centuries-old cattle raids from up the mountains are still a problem for them, and they cannot follow up on any leads because of the restrictions against going into the protected areas.

Sekukhona lo mngcele ukuthi iParks Board ingahlangani nathi – kwakungumkhuba wokuthi wena qobo lwakho uma ubonakala ngale ezintabeni ufuna impahla yakho, akubambe amaphoyisa akoParks Board, akubophele ukuthi "ubani othe uhamba la? Iphi ipasipoti youkuhamba kuleyi ndawo?" Thina sivinjiwe ukuze singabe sisaya entabeni. Kanti entabeni thina sikhula singabafana, besihamba khona, sihamba nezinja sizingela sisenzani. Sigawula izinduku – senza yonke imikhuba yabafana. Bonke abantu babehamba entabeni. Kodwa ngokunqamuka kokuthi kufakwe leli curtain lokuthi sisale ngala, leya indawo yasala ikhamisile (Mr Majozi, FGD October 26, 2010).

{Now there is this boundary so that we are separated from Parks Board [territory]. The result is, if you are seen out there in the mountains looking for your cattle, the Park security will arrest you, and will want to know "Who said you could walk here? Where is the permit to walk in this place?" We are not allowed to go to the mountains. But when we were still growing up as boys, we would walk around the mountains; we would hunt with our dogs, and do all sorts of things. We would make our fighting sticks and did all that was expected of young boys. Everyone used to go to the mountains. But now, with the creation of this curtain which now confines us to this place, that area [the mountains] is now open}

The explanation from a conservationist perspective is that there is need for a buffer to protect nature in uKhahlamba from human interference (Ezemvelo KZN Wildlife, 2011). It is not clear whether the locals have ever been consulted in all the conservation efforts made since the late 1800s. What is clear is that the current generation of Elders in Mqatsheni are very bitter about the land situation. They are at the doorstep of a piece of land that the 'world' calls its heritage - a place that for generations has been part of their culture and identity, but they no longer have freedom of movement into the area. This is in spite of an abundance of literature which suggests that lack of consultation with, and restricting local people neighbouring a Park, contributes to unsuccessful conservation efforts (Agrawal & Redford, 2009; Muhumuza & Balkwill, 2013; Mbile, Vabi, Meboka, Okon, Arrey-Mbo et al., 2005).

For centuries, children roamed the mountains herding cattle, fetching wood and learning about nature, plants and their own roles in the community. Girls and boys lived in the hills for weeks during their initiation training and returned transformed into women and men. The mountains were the training grounds for youth into a Zulu identity. For the Elders, separation from the mountains is not simply a conservation decision, but a deliberate decision to separate them from their sense of place. It is a political decision that has contributed to the loss of their knowledge and practices. It is ironic that uKhahlamba is recognised for its symbolic and spiritual values (Ezemvelo KZN Wildlife, 2011), yet the people who may be most closely connected to it are 'cut off' from the same. Propositions for a Wilderness Management Steering Committee (Ezemvelo KZN

Wildlife, 2011) do not even hint at including representatives from the rural community. This scenario is suggestive of conservation efforts that ignore socio-cultural issues relating to indigenous populations, and such efforts are not always successful (Muhumuza & Balkwill, 2013).

The issues raised above are important in thinking about the extent to which Indigenous knowledge exists in Mqatsheni and nearby rural communities. An ironic situation that emerges here is about the possibility of the democratic government of South Africa actually contributing to the loss of indigenous practices and values.

Another dimension of the changing context of Mqatsheni came with HIV/AIDS. In addition to depriving many children of parents, the AIDS pandemic has left (and continues to leave) many children in the hands of either their grandparents or great-grandparents while other children even have to look after themselves, their ailing parents and their siblings (Ntleko, 2012). While neighbours and volunteers from NGOs such as Khuphuka are active in helping such vulnerable children, cases of corruption and abuse increase the threat to the children's wellbeing.

2.6 Expectations

The socio-economic and political conditions of Mqatsheni weigh heavily on the Elders. In our meetings, the Elders repeatedly referred to the challenges the community faces, chief among which are:

- Increasingly smaller land sizes due to the effect of the expansion of commercial farmland, the establishment of nature reserves and the problem of invasive plants.
- Lack of means to send children for tertiary education.
- High levels of youth unemployment.
- Stock theft.

The Elders are quite emotional when they discuss these issues, especially because no one in government seems to attend to their concerns. They do not hide their lack of faith in getting government assistance, and neither did they conceal their hope that involvement in this study may bring solutions to these problems. Sometimes they directly ask what benefits their participation would bring:

Yiluphi usizo ozasisiza ngalo? Ungasithembisa ngoba sinje namhlanje? (Mr Cekwane, FGD October 26, 2010).
{Of what help will you be to us? Can you promise us here and now?}

At other times they make direct requests on behalf of the community:

…nakho ukufunda kwezingane siyacela bandla ukuthi nisekwelele. Ingane zethu zisenkingeni enkulu kabi. Ziningi ezinoStandard 10, kodwa umsebenzi awukho (Mrs Luswazi, FGD May 12, 2010).
{…and about the education of our children, we please request that you help us. Our children face huge challenges. Many of them have done Standard 10 (the school-leaving certificate), but there are no jobs}.

Siyafisa kakhulu ukuthi niwujikele lowo mlayezo nakwamanye amazwe ukuthi siyafisa ukusizwa endaweni yakithi. Siyafisa intsha yakithi isizakale. Siyafisa nathi qobo ukuthi ngelinye ilanga sizibone nathi sihlukile entweni esiyiyona (Ms Majozi, FGD May 12, 2010).
{We wish that you send this message even to other countries that we are looking for help. We wish for our youth to be helped. We also wish for ourselves, that one day we can see ourselves transformed from our present state}.

At yet other times the Elders simply present 'wish lists'. They wish for economic power to restore eroded land; to rid the land of invasive plants; to find a permanent solution to the problem of stock theft; to revive farming activities and to create employment for the out-of-school youth. Considering that our NGO friend, Khuphuka, brings direct benefits to the community through providing employment and support for families affected by HIV/AIDS, it might have come naturally that the Elders expect 'help' in tangible ways. It appears the ability of the older generation to exercise agency may have been lost together with the sense of connection to place.

The process of building relationships has had to include the levelling out of expectations to achievable levels, and within the framework of a research study. We[15] have had to continually negotiate the benefits of the study for the community. Tangible benefits are more meaningful and relevant for the community participants than the research knowledge outcomes; conventional research puts emphasis on production of knowledge for its own sake. Finding the middle ground in divergent research outcomes was one of the emerging goals of this study.

[15] From the perspective of the broader project.

At the beginning, the teachers were anxious that the study would encroach on school time. I committed to working with teachers and students at times that least disrupted the smooth running of the school day. Most meetings with students were set for lunch times and free periods. We shared refreshments with students during these meetings.

2.7 Summary

My understanding of the context of Mqatsheni was a process and not an event. The physical, social, economic, historical and political contexts are intertwined in complex ways, but they all served to open spaces for a broader, more holistic understanding of the research site. In many ways, these experiences shaped the development of the study, particularly, my appreciation of the research site as a unique space that needed to be understood in its own terms. My experiences in Mqatsheni challenged my assumptions, but in the process enhanced my understanding of my own role in developing relationships with the community in gathering data and in constructing meaning from the data. The better I understood both the community circumstances and expectations, the more discussion was necessary to clarify purposes of the study, not in ways that were dismissive of local concerns, but as an attempt to come to a collaborative understanding on feasible project benefits which were commensurate with available resources, and which could still be in line with University expectations. I discuss these issues further in Chapter 4.

In the next chapter I present a review of literature in the area of Indigenous knowledge and worldview in relation to science education.

PART TWO

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CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

Formal schooling in the Western sense is a phenomenon that was introduced to many indigenous peoples at about the same time that their territories were colonised by Western powers. Before then, education in traditional African societies was meant to equip young people for their gender-specific roles in society (Adeyemi & Adeyinka, 2003). In pre-apartheid South Africa, modern schooling among Indigenous populations came largely through Christian missionaries. Although education by the missionaries was largely seen as intended for good, critics have pointed out how mission education subtly suppressed the people's mental capacities through its displacement of local ways of knowing and living, as well as local forms of education (Molteno, 1984; Christie, 1991). The apartheid government took over the education of the Black population in 1951 and created the infamous Bantu Education which was meant to prepare Blacks for subordinate roles. Therefore, neither mission education nor Bantu education recognised the knowledge of Indigenous peoples.

When apartheid rule ended in 1994, education became a major target for reform, in order to rid the curriculum of apartheid content and method and work towards social justice. The result was a new Outcomes-Based Education (OBE) curriculum effected in 1997. Changes in the new curriculum included the recognition and valuing of Indigenous Knowledge Systems (IKS) as one of the principles of the curriculum, and a shift in focus from subject content to learner-centredness through a focus on learning outcomes (DOE, 2003). When interpreted from a social constructivist perspective, a learner-centred curriculum involves recognition of the role played by learners' sociocultural contexts in shaping the knowledge and worldviews that they bring into the classroom (Vygotsky, 1978; Wertsch, 1985). In exploring the implications of learner-centredness in

the classroom, Malcolm and Keane (2001) identify three levels through which teachers can show learner-centredness, in order of complexity: caring for students; learner-centred pedagogy; and learner-centred outcomes. Malcolm and Keane (2001) place the three forms of learner-centredness in a continuum where lower levels are subsumed by the higher levels. For them, the ideal learner-centred classroom reaches into the third level, where students are allowed space to see how their thinking is shaped by their experiences, their histories, social structures and cultures. Teaching that strives for the third level of learner-centredness is likely to find the principle of valuing indigenous knowledge in the classroom easier to deal with. Putting into practice these ideals may not be easy, especially with regards to IK and science integration.

In communities where members lead a traditional lifestyle, everyday experiences may include elements of localised knowledge, which in some cases may be described as 'indigenous'. The inclusion of such knowledge in school science has attracted much research in many parts of the world. Conferences and symposia have been devoted to the issue of IKS and books and journals have been published on the subject. Projects have been implemented to document IK for use in (among others), environmental conservation; disaster management and education. The inclusion of Indigenous Knowledge Systems (IKS) in education in general, and in science education in particular, is not peculiar to South Africa[16]. Australia, Canada, India, Japan, New Zealand and the United States (especially Alaska) are examples where steps have been taken to recognise and include indigenous knowledge in education. This inclusion comes as a result of education research recognising the dissonance between what is taught formally in schools and what learners, particularly those of non-Western backgrounds, experience in their everyday life. The differences not only hinder achievement in science (Aikenhead, 1996; Jegede, 1995), but also raise questions of relevance of (Keane, 2005; Keane & Malcolm, 2003) and sustained learner interest in science (Fensham & Law, 2003).

Indigenous Knowledge (IK) has in the last few decades become a subject of both public debate and research worldwide. Proponents for IK in education argue from a human rights and social justice perspective (e.g. Battiste, 2005; Odora-Hoppers, 2002a) while others argue from a pedagogical point of view (e.g. Aikenhead 1996; Jegede, 1995). In

[16] Indigenous Knowledge Systems (IKS) are part of the principles of the National Curriculum Statements (NCS, Grades 10-12); the Revised National Curriculum Statements (RNCS, Grades R-9); as well as the latest curriculum revision, the Curriculum and Assessment Policy Statements (CAPS), which took effect in January 2012.

the South African National Curriculum Statements (NCS), "valuing indigenous knowledge systems" is one of the principles on which the curriculum is based, and it is justified on the basis of both social justice and pedagogy (Department of Education, 2003). In the Curriculum and Assessment Policy Statements (CAPS), there is greater emphasis on the pedagogical side, with integration of IK and science aimed at achieving better learner understanding (Department of Basic Education, 2011). It is from this background that I present a review of the literature on the integration of IK and school science using my research questions as a guide to the discussion.

3.2 Identifying Indigenous Knowledge

Identifying knowledge that can be characterised as 'indigenous' is an important first step when thinking about IK and science integration. However, the identification process depends on how both the concepts 'indigenous' and 'knowledge' are defined. Both these concepts are the subject of debate in philosophy and in science education. I present some of these debates in the following sub-sections.

3.2.1 Defining 'indigenous'

'Indigenous knowledge systems' and 'indigenous knowledge' are complex concepts to define. The complexity partly stems from the lack of consensus on who or what qualifies as *indigenous*, and also partly from what constitutes *knowledge*. 'Indigenous' implies belonging to or originating in an area, or naturally living, growing or produced in an area. However, the migratory characteristic of human beings makes it difficult to think of *indigenous* knowledge in an absolute sense (Ogunniyi & Ogawa, 2008). The length of time to qualify as indigenous to a place is therefore relative, but not always clearly stated in definitions. The World Council of Indigenous People, for instance, defines indigenous peoples as:

> …population groups who from ancient times have inhabited the lands where we live, who are aware of having a character of their own, with social traditions and means of expression that are linked to the country inherited from our ancestors, with a language of our own, and having essential and unique characteristics which confer upon us a strong conviction of belonging to a people, who have an identity in ourselves and should be thus regarded by others (IUCN Inter-Commission Task Force on Indigenous Peoples, 1997, p. 27)

The attributes of indigenous peoples in the definition above are an important guide in identifying knowledge and practices that qualify as indigenous to *place*. However, the definition does not specify how long it is since 'ancient times', and many population

groups are known to have migrated in the last few centuries. An awareness of the unique attributes of a population group may be eroded over time due to interaction with other peoples.

The South African Department of Education (2003) and Hewson and Ogunniyi (2011) are among few authors who give an indication of the time frame that qualifies knowledge as indigenous:

> Indigenous knowledge systems in the South African context refer to a body of knowledge embedded in African Philosophical thinking and social practices that have evolved over thousands of years (Department of Education, 2003, p. 4).

> Knowledge systems that existed in numerous parts of the non-Western world before the advent of colonialism are referred to as indigenous knowledge systems (IKS) (Hewson and Ogunniyi, 2011, p. 680).

The South African Department of Education (2003) qualifies knowledge as 'indigenous' if it can be described as 'African', and if it has 'evolved' for thousands of years. The Department of Education upholds an important dimension of IK - that it is dynamic and so cannot be preserved and passed on in its entirety over a long period of time. Knowledge evolves through interaction with changing contexts and other knowledges. In the case of South Africa, indigenous knowledges might have been influenced through the interaction amongst different tribal groups as well as with the settlers. The use of the yardstick of 'African' to accept knowledge as 'indigenous', must be contested as constricted. If the motive for the promotion of IKS is one of increasing inclusion, then it would be judicious that all IKS be considered (Moyo, 2011), otherwise the Department of Education's (2003) view defeats the national purposes of social transformation and inclusivity.

For Hewson and Ogunniyi (2011) the timeframe that qualifies knowledge as 'indigenous' in the African context is if it (the knowledge) existed in pre-colonial times. However, Western colonial settlers brought their own knowledges which in some cases could be described as 'indigenous'. Western modern knowledge and values (brought into indigenous communities through colonialism) are a product of industrial capitalism, whose growth systematically suppressed and displaced traditional values and knowledges outwards from the source regions, through processes of imposition and adoption. Therefore, it is my view that indigenous knowledges existed in both the Western and non-Western worlds, and that different forms of IK may still exist among

South Africans of different ethnic origins. The knowledge held by such ethnic groups may not have the South African natural environment as its source region, but may have been modified over time through social interaction.

Another level of challenge with regards to the use of the concept 'indigenous' is its implied suggestions about power. In some cases, the use of the concept is based on a Western knowledge framework (Battiste, 2005) and reflects the power relations with other knowledge systems. For instance, 'indigenous' sometimes conjures up ideas of 'primitive' 'wild', 'naïve' and 'unscientific', 'old' information that is essentially unchanged (Battiste, 2005; Houtondji, 2002), and which may evoke derision (Semali and Kincheloe, 1999). The negative connotation of the term 'indigenous', has influenced some scholars to use the term 'endogenous' instead (e.g. Houtondji, 2002). On the other hand, the use of the concept 'indigenous', as used in Aikenhead's (2006a) and Ogawa's (1995) description of science, implies that Western and indigenous science can share the same space of privilege. As is the case with 'indigenous knowledge', not all science education researchers accept the notion of describing science as 'indigenous' (e.g. El Hani & Bandeira, 2008). The concept 'indigenous' can therefore be used to convey different messages about its place in academic debate. One therefore needs to always 'read between the lines' to understand the meaning of 'indigenous' a particular writer intends to convey.

Because of this lack of consensus the United Nations has not adopted a singular definition of who is "indigenous", but has compiled a list of descriptors that provides an inclusive understanding of the term, based on:

- Self- identification as indigenous peoples at the individual level and accepted by the community as their member.
- Historical continuity with pre-colonial and/or pre-settler societies
- Strong link to territories and surrounding natural resources
- Distinct social, economic or political systems
- Distinct language, culture and beliefs
- Form non-dominant groups of society[17]
- Resolve to maintain and reproduce their ancestral environments and systems as distinctive peoples and communities

(United Nations Forum on Indigenous Issues, Fact Sheet 1)

[17] IsiZulu home-language speakers constitute 22.9% of South Africa's population (Statistics South Africa, 1998), making Zulus the largest tribal group in the country. Therefore, in terms of numbers, the Zulus are a dominant group. The people of Mqatsheni are a 'non-dominant' group in terms of recognition of their knowledge and ways of living.

Descriptors such as ‘Aboriginal’, ‘Native’, and ‘First Nations’ have been used in literature in the place of ‘indigenous’, e.g. Aikenhead (1996); and Kawagley, Norris-Tull and Norris-Tull (1998). In the South African context the San are considered the First People (/Useb & Chennells, 2004; Prins, 2009), and would therefore best qualify as ‘indigenous’ to Southern Africa[18]. In this study, I will extend the use of the term ‘indigenous’ to people known to be of African descent before the settling of Western peoples in the seventeenth century. These people are considered as Zulus today, but could include descendants of the San (and other tribes) who occupied the UKhahlamba Mountains before the Zulus, and could have taken on a Zulu identity as a survival strategy (Prins, 2009; Wright & Mazel, 2012). I assume that the group of ‘indigenous’ people in Mqatsheni is heterogeneous, because of the influences of trade, political systems and intermarriages (Prins, 2009). My use of the term ‘indigenous’ to refer only to people of African descent is not to be interpreted as meaning that other racial groups do not have IK. The reason is to delineate the boundaries of my study, and to retain the sense of place that IK has (Aikenhead, 2001a; Cajete, 2008).

3.2.2 Defining knowledge

Another complexity that arises in creating a definition for IK is the concept ‘knowledge’. There is no consensus as to what counts as knowledge. On the one hand are philosophers who insist on the use of one way of defining knowledge (e.g. Horsthemke, 2004). Horsthemke (2004) argues against the description of any knowledge as ‘indigenous’ because there is no certainty about the extent to which a framework can be ‘indigenous’. For him knowledge is knowledge so long as it meets the philosophical account of the nature of knowledge. Horsthemke acknowledges variation in the grounds for belief, and the procedures for validation of knowledge from one knowledge system to another.

Another way to look at knowledge is from a pluralistic perspective, in which knowledge is viewed as a socio-cultural and historical construction (Turnbull, 1997). In this view, all societies are capable of producing knowledge, but there are expected cross-cultural variations in the way in which knowledge is assembled and disseminated (Le Grange, 2008; Turnbull, 1997). What qualifies as knowledge depends on the ways in which societies categorize, code, process and impute meaning to their experiences (Studley, 1998). Turnbull (1997) clarifies:

[18] The San are the people with legitimate rights to indigeneity in most parts of Southern Africa. They were, however, progressively dominated and even decimated by various African and later, Western settlers, almost to extinction (/Useb & Chennells|, 2004).

> Some traditions move it [knowledge] and assemble it through art, ceremony and ritual; [Western] science does it through forming disciplinary societies, building instruments, standardisation techniques and writing articles. In both cases it is a process of knowledge assembly through making connections and negotiating equivalences between the heterogeneous components while simultaneously establishing a social order of trust and authority resulting in a knowledge space (p. 553).

For centuries, Western knowledge has been widely disseminated from the point of production to other places and other times. The process of colonisation with its political and ideological conquest was instrumental in not only propelling Western knowledge on both global and temporal scales, but also in thwarting the diffusion of other knowledges.

Knowledge is something everyone possesses (Studley, 1998), hence the description of knowledge and philosophies as, for instance, 'indigenous African' (Higgs, 2008). Higgs highlights the differences in methods between African and Western philosophy, which he explains results from the Western pursuit of philosophical discourse for its own sake, as opposed to African philosophy that is used to address particular social issues. Van Eijck & Roth (2007) share similar views and propose the consideration of the extent to which knowledge is useful to a community, as a more reliable measure of its validity. Relevance and usefulness are key considerations in the non-Western philosophical discourse where utility is at the fore in knowledge creation. The African reality, according to Higgs, gives rise to '*an* (my emphasis) indigenous African knowledge system'. Higgs's (2008) reference to '*an* indigenous African knowledge system' however overlooks the existence of variation among 'African' knowledge systems. Higgs misses the plurality of ways of knowing among different African peoples arising from differences in local environmental conditions. Ambiola (2006) stresses the cultural diversity amongst the Yoruba people, and Mbiti (1969) emphasizes the diversity of religious practices among different African tribal grouping and clans. Even for South Africa, it would be erroneous to assume the existence of a singular 'South African' knowledge system. South Africa's eleven officially recognised languages[19] are representative of eleven ethnic groups, each of which might have different way of knowing.

Knowledge from a non-Western perspective is viewed as inseparable from the knower: the knower seeks after wisdom and not knowledge *per se*, as in Eurocentric cultures. This wisdom is "intimately and subjectively related to human action", (Aikenhead &

[19] Only eleven out of the languages spoken by South Africans are officially recognised.

Ogawa, 2007), and is process-oriented and experiential. Aikenhead and Ogawa (2007), further explain that the noun "knowledge" is not found in many indigenous languages, and the closest translation is "ways of knowing" or "coming to know". Ogunniyi and Ogawa (2008) concur with Aikenhead and Ogawa (2007), and present this explanation of knowledge:

> Knowledge, a noun within the western science is to the indigenous peoples an action verb which can be translated as 'ways of living' and sometimes 'ways of being'. It can also be translated as a journey towards wisdom rather than reaching a destination. In short, knowledge is a way of living and behaving properly, the pursuit of wisdom or simply 'wisdom-in-action' (Ogunniyi & Ogawa, 2008, p. 178).

I extract from this discussion two views of knowledge. On the one hand, there is a view of 'knowledge' as a noun, whose quality can be tested by accepted theoretical means. On the other hand, 'knowledge' may be viewed as a process/action. Since it would be problematic to test the quality of this knowledge-as-process or action by external means, I concur with Aikenhead and Ogawa (2007) that indigenous knowledge is internally consistent at community level, and hence, self-validating. What counts as indigenous knowledge is therefore not only theoretical and noun-based, and neither is it just what one has already acquired and is testable. Knowledge also comes as action (Battiste, 2002; 2005). Consequently, for this study I consider knowledge as comprising factual aspects, processes/actions and also the values that guide those actions.

3.2.3 Indigenous knowledge (IK) and Indigenous knowledge systems (IKS)

Indigenous knowledge is variously presented in the literature as 'indigenous knowledge/technology' (Dekkers, 2005; Maluleka, Wilkinson & Gumbo, 2006; Snively & Corsiglia, 2000); 'traditional ecological knowledge' (Turner, Ignace & Ignace, 2000); 'indigenous local knowledge' (Atteh, 1992); 'traditional/local knowledge' (Mazzochi, 2006), 'indigenous/native science' (Aikenhead, 2006a). Indigenous knowledge systems (IKS), is an integrated pattern of human knowledge, beliefs, and behaviour (Atteh, 1992). Language, ideas, beliefs, customs, taboos, rituals, ceremonies, folk stories, artefacts and techniques all combine as constituents of IKS. IKS is thus a "combination of knowledge systems encompassing technology, social, economic and philosophical learning, or educational, legal and governance systems" (Odora Hoppers, 2002a, p. 9,10). IKS is "a conglomeration…a redemptive, holistic, and transcendental view of human experience with the cosmos…" (Ogunniyi, 2007a, p. 965) IKS is not just about crafts and traditional dances but includes the thinking behind those practices and artefacts. It is a "…systematic reference to the knowledge and practices of indigenous

communities constitutive of their meaning and belief systems, as well as the substantive dimension of their practices and customs" (Nel, 2005:7). Because IKS has a spiritual dimension, it has to be understood as an inclusive way of life, and a way for people to understand themselves (Keane, 2008a; Mbiti, 1969). I will quote the Inter-Commission Task Force on Indigenous Peoples' definition of IKS to illustrate this point:

> Indigenous Knowledge Systems are local, community-based systems of knowledge which are unique to a given culture or society and have developed as the culture has evolved over many generations of inhabiting a particular ecosystem. IKS is a general term which refers broadly to the collective knowledge of an Indigenous People about relationships between people, habitat and nature. It encompasses knowledge commonly known within a community or a people as well as knowledge which may be known only to a shaman, tribal elders, a lineage group, or a gender group (Onwu & Mosimege, 2004, p. 2).

IKS therefore includes technologies and practices used both in the past and present by indigenous peoples for their survival in a variety of environments (Onwu & Mosimege, 2004). Some knowledge may be common to all members of a community, and as such may be easier to share with outsiders, while other, more specialised (and sometimes secret) knowledge is only held by certain members of the group. IKS is thus described as a broad field which takes a plural form. For instance, Atteh, 1992; Odora Hoppers, 2002a; Ogunniyi, 2007a describe the knowledge using terms like 'integrated'; 'combination'; 'conglomeration'; and 'collective'. These descriptions suggest IKS represents the sum total of a community's knowledge, practices, and belief systems. Indigenous knowledge (IK) is a component of IKS. IK constitutes those aspects of IKS which are more likely to be identifiable in the field as part of the life ways of participants, and which could be used in the science classroom (Otulaja, Cameron & Msimanga, 2011).

3.2.4 Implications for my study

As discussed in the previous sections, literature presents no common criteria for determining human indigeneity and what qualifies as knowledge. Several factors make defining indigeneity hard. Firstly, humans are migratory, so defining 'indigenous would need a clear time frame. Secondly, the dynamism of socio-political systems results in changes of meanings of phenomena with time. For instance, during the colonial era for many countries, 'indigenous' could be easily associated with skin colour. Care therefore has to be taken in defining who is 'indigenous' as definitions may vary according to the definer's political, economic, educational, or other interests. A similar challenge is faced in defining knowledge. Firstly, it is difficult to come up with a common understanding of what knowledge is when there are no agreements about how we come to know.

Secondly, differences in area or point of focus results in disagreements e.g. some philosophers are more interested in propositional knowledge, while researchers in indigenous knowledge are interested in knowledge in its totality. Thirdly, the link of knowledge with power also encourages gate-keeping devices which keep 'other' knowledge out.

For the purposes of this study, I define indigenous knowledge as constituting factual knowledge and practical knowledge (including value systems) that a community continually constructs from their interactions within given natural and socio-cultural environments. While factual and practical knowledges are different, they are also closely related and continually influence each other, and at the same time shape the peoples' survival strategies. It is from that basis that I set out to identify IK in Mqatsheni that could be used in science education. My view of indigenous knowledge is not that of a theoretical construct, only testable by pencil and paper examinations, but also as action (Battiste, 2002; 2005; Ogunniyi & Ogawa, 2008). I take IK as present day knowledge which has been shaped by "different kinds of precedent cultures or civilizations" (Ogawa, 2004 in Aikenhead 2006a, p. 2). IK is often reflected in culture – a construct that Odora Hoppers (2009: 604) describes as "the totality of socially transmitted behaviour patterns, arts, beliefs, institutions and all other products of human work and thought". The breadth of IK as seen through culture presents challenges for integration with the school knowledge system which is categorised into strict knowledge disciplines.

3.3 The Nature of Indigenous Knowledge

Scholars from across the globe have contributed to our understanding of the nature of Indigenous knowledge, and to our appreciation of how IK differs from Western knowledge. These scholars highlight both the plurality of local knowledges, and the common characteristics among them. Knowledge that is described as 'indigenous' is neither static nor ancient, and thus must not be treated as a "historical artefact far removed from contemporary life" (Semali & Kincheloe, 1999, p. 22). Even prior to colonisation, indigenous peoples were not isolated from the rest of the world and so their ways of knowing were continuously influenced by other knowledge systems (Prins, 2009; Wright & Mazel, 2012). Such influence often manifests as change in sets of values. In some cases, different groups within a community may experience tensions that result from the absorption of new values (Odora Hoppers, 2010), which might result in the chipping away of the status of some forms of traditionally valued authority

(Malcolm, Sutherland & Keane, 2008). IK should therefore not be relegated to a distant millennium. It is quite appropriate to refer to IK in the present tense because it is ever evolving, acculturating other knowledges and technologies (Aikenhead, 2006a; 2006b). IK is socially and historically constructed, always in process – and evolving in time. IK is added to, modified (and unfortunately, sometimes destroyed and lost) during interface with knowledge from outside (Chambers, 1983). Finding knowledge that is purely *indigenous* to a particular group is scarcely possible.

Indigenous knowledge is place-based (Chinn, 2007). Although there may be common knowledge amongst Indigenous peoples in different localities, there are features of IK that are peculiar to individual groups (Aikenhead & Michell, 2011; Michell, 2005). Language plays a crucial role in the transmission of indigenous knowledge (Battiste, 2002). Through indigenous languages, knowledge has been passed down through generations, as evidenced by the Indigenous knowledge that young people possess. For instance, in a study of indigenous foods among the Xhosa people of South Africa, Shava (2000) found out that the youth knew a lot about food plants. The oral transmission of IK in a contemporary, textualised knowledge era has raised concerns about its loss, and resulted in calls for documentation for the sake of posterity (Onwu & Mosimege, 2004) as well as for educational purposes (Otulaja, Cameron & Msimanga, 2011). Oral transmission presents difficulties where the receiver speaks a different language or comes from a different cultural experience. Knowledge can be lost in translation and in the failure to decode language and the behaviour symbols through which indigenous knowledge is stored (Aikenhead, 2001).

Place-based IK cuts across Western modern knowledge disciplines (Kawagley & Barnhardt, 1998; Loubser, 2005). For example, it includes aspects of agriculture, medicine, botany, art and music. IK is holistic and is not amenable to categorisation. The transmission and acquisition of IK often involves demonstrations and imitation. The knowledge is learnt less for its own sake than for practical and survival purposes. IK is more experiential than it is theoretical, and thus cannot be viewed simply as a commodity that can be possessed or controlled by educational institutions, but as a living process to be absorbed, understood and lived (Battiste, 2002). IK develops through rational empirical means and has been tested in nature over many generations – a process that authenticates and strengthens its relevance and utility.

IK manifests through among other things, language, beliefs, values, customs, institutions, technologies, education, artefacts, games, food, rituals and ceremonies

(Gadzirayi, Mutandwa, Chihiya, & Chikosha, 2006; Nkopodi & Mosimege, 2009; Nyota & Mapara, 2008; Roux, 2007), and Elders are the "repositories of information and experience" (Sutherland & Henning, 2009). The construction of IK is not limited to that which is perceivable by the senses, but includes what is beyond the senses (Ogunniyi, 2004), for instance, intuition and dreams. What is observable as Indigenous knowledge is underpinned by distinct views of reality. Indigenous knowledge is relationship-oriented, encompassing social and spiritual relationships as well as relationships between humans and their physical environment (Semali & Kincheloe, 1999). The knowledge is an ingrained part of a culture's life-ways, often underpinned by distinct worldviews and may therefore not always be easily identifiable (Keane, 2008a). Identifying IK in the field requires the establishment of appropriate relationships with knowledge holders (Odora Hoppers, 2002a). In this study, I draw on the understanding of the nature of Indigenous knowledge presented in the literature to shape my approach. It is with the nature of IK in mind that I chose transformative participatory research (TPR) as an appropriate approach for this study. I discuss the TPR in detail in chapter 4. In the next section, I present literature on worldview. Understanding a people's worldview is critical in understanding their Indigenous knowledge.

3.4 Worldview

3.4.1 The meaning of worldview

Interest in understanding worldview originated in anthropology, and over the years the subject has attracted the interest of science education researchers. Worldview looks at the person's total understanding of himself or herself, the world and his or her place in it. Focus is not just on a people's shared assumptions, but also on those assumptions that rest with the individual (Cobern, 1998; Kearney, 1984). According to Cobern (1998:155) worldview is the "culturally dependent, generally subconscious, fundamental organisation of the mind, which manifests itself as a set of presuppositions and predisposes one to feel, think and act in predictable patterns". A person may not necessarily be aware of what their worldview is, but their thoughts and actions may point others to how they view the world. An important pointer to worldview is our set of values, because these values are often influenced by how we see ourselves in the world (Keane, 2011).

Cobern (2000) further clarifies the concept of worldview as follows:

> Worldview defines the self. It sets the boundaries of who and what *I am*. It also defines everything that is *not me*, including my relationships to the human and non-human environments. It shapes one's view of the universe, one's conception of time and of space. It influences one's norms and values (p. 8-9, emphasis in the original).

Cobern's observations imply that from interacting with a person, I may be able to understand their worldview, particularly if their worldview comes across as different from mine.

Worldview is the way in which one views and experiences life (Nisbett (2003). We cannot think about worldview apart from our socio-cultural contexts, because, social organisation can influence cognitive processes (Nisbett, Peng, Choi & Norenzayan, 2001). Culture programmes a person's thoughts, feelings and actions (Jegede, 1995). This relationship between a person's worldview and their socio-cultural context has been widely researched, especially amongst American and Asian students (e.g. Nisbett, 2003; Nisbett, Peng, Choi & Norenzayan, 2001; Nonaka & Takeuchi, 1995). Differences in thought patterns (worldview) between Asians and Westerners have been observed in these studies, and these differences manifest in the holders' approaches to knowledge (Nonaka & Takeuchi, 1995). Asians have been observed as paying greater attention to their social environment and to relationships than their American counterparts (Ji, Peng & Nisbett, 2000). Westerners are observed as viewing knowledge as explicit, formal and systematic. "Explicit knowledge can be expressed in words and numbers, and easily communicated and shared in the form of hard data, scientific formulae, codified procedures, or universal principles" (Nonaka & Takeuchi, 1995, p. 8). Asians (Japanese, in this case) however have a different approach to knowledge:

> They recognise that the knowledge expressed in words and numbers represents only the tip of the iceberg. They view knowledge as primarily "tacit" – something not easily visible and expressible…highly personal and hard to formalise, making it difficult to communicate and share with others…(it) is deeply rooted in an individual's action and experience, as well as in the ideals, values, or emotions he/she embraces" (Nonaka and Takeuchi, 1995, p. 8).

Differences between Western and non-Western worldviews have also been observed in other parts of the world, for example, Nigeria (Jegede, 1995) and South Africa (Keane, 2008a; 2006a; 2006b; Ogunniyi, 2002). It is important to note that these worldview differences exist along a continuum, hence they are not to be perceived as dichotomous categories (Nisbett, 2003). Although there could be worldview differences among African tribal groups, studies reveal the existence of the following common worldview characteristics:

- anthropomorphism (Ogunniyi, 2002);
- collective co-existence and interdependence (Keane, 2006; Odora Hoppers, 2005; Mbiti, 1969);
- hierarchy (Khupe, Cameron & Keane, 2010);
- cooperation (Hamminga, 2005);
- harmony (avoidance of conflict) (Hamminga, 2005);

These studies show that collective co-existence and interdependence are key elements of the African worldview. The individual is seen as dependent on a group. The African notion *ubuntu*[20] expresses this well, and Mbiti's (1969, p. 141) statement, "I am because we are; and since we are, therefore I am", is a fitting description of this relationship between the individual and the rest of the community in an African setting. In *ubuntu*, the individual is understood primarily in relation to others. *Ubuntu* is therefore the "fountain from which actions and attitudes flow" (Kamwangamalu, 1999:27). The emphasis on relationships and interdependence in the African context does not end at a social level but extends to the physical and spiritual realms (Odora Hoppers, 2005).

It is not possible to know everything pertaining to a person's worldview. One is limited by the very nature of worldview – the fact that it often dwells in the subconscious (Cobern, 1998). However, from interacting with communities, it is possible to develop an understanding of how they view reality. In this study, I analysed data on worldview through identifying emerging themes as well as through drawing on constructs from literature (for example, Kearney, 1984; Mbiti, 1969; Nisbett, 2003).

Our present understanding of the influence of worldview in science education has come from the work of United Sates-based William Cobern (see Cobern, 2000; 1996; 1993; 1991; 1989; Cobern, Ellington & Schores, 1990). Empirical work from other parts of the world includes Aikenhead's (2006b) work in Canada; Hansson and Lindahl (2010) in Sweden; Jegede (1995), Jegede and Okebukola (1991) in Nigeria; Kawagley, Norris-Tull and Norris-Tull (1998) in Alaska; and Cameron (2007), Keane (2008a; 2006a; 2006b) and Lawrenz and Gray (1995) in South Africa. These studies clarify our understanding of the influence of students' view of the world on science learning. The contribution of this study is in understanding the worldview of the students in Mqatsheni, and how that could influence science teaching and learning in their context.

[20] Ubuntu is an important value in many traditional African communities where relationships are at the centre of their worldview.

Findings from many studies on worldview suggest that school science teaching has little influence on students' views about Nature (Cobern, 2000; 1993; Cobern, Ellington & Schores, 1990). Students' understandings of Nature are from multiple perspectives, including aesthetic, religious, mythic, conservationist, and only sometimes scientific (Cameron, 2007; Cobern, 1993; Lawrenz & Gray, 1995). Dissonance between students' worldviews and science-related worldviews are also found in Hansson & Lindahl (2010) and Keane (2008), where a link between worldview presuppositions and self-identity was revealed; suggesting that science teaching and learning includes identity issues. Such a link between worldviews and students' self-identities also appears in Aikenhead (2006b). Making reference to several other cross-cultural science education researchers, Aikenhead observes:

> Discordant worldviews create an incompatibility between, on the one hand, students' self-identities (e.g. who they are, where they have been, where they are going and who they want to become); and on the other hand:
>
> - Students' views of Western science, school science or their science teacher, and
> - Students' views of the kind of person they think they must become in order to engage in science (Aikenhead, 2006b, p. 107-108).

Very often, students do not have school science as part of their identity, hence they feel 'excluded' from the science class, resulting in less meaningful engagement with science. Student participants in Keane (2008a) defined their personal goals and visions in relation to their community, rather than in terms of personal career goals, which points to a strong social self-concept. Considering that school science draws from Western values, it emphasises the autonomous self rather than the social self (Keane, 2008a), highlighting the dissonance with non-Western students' worldviews. Surprisingly, some students still do pass science in spite of discordant worldviews. In some cases this is because the students choose to learn science content even though they do not believe it. Explanations of how students overcome the discordance in their worldviews and that of science are given in Aikenhead (1996). However, students may still not sufficiently engage with science in a way that encourages them to pursue tertiary studies in the subject (Hansson & Lindahl, 2010).

What I learn from these studies is that historical and cultural factors have a strong influence on the development of a person's worldview. However, even people who belong to a fairly homogenous group may view Nature from multiple perspectives (Aikenhead & Michell, 2011; Cobern, Ellington & Schores, 1990). It is from this

understanding that I sought to understand the worldview underpinnings of the people of Mqatsheni, in order to understand how that could contribute to students' learning. Science students' worldviews are not always consistent with those of their teachers and with the scientific view (Cameron, 2007; Cobern, 2000). The difference between students' worldviews and the scientific worldview does contribute to the difficulties students have in learning science (Aikenhead, 1996; Keane, 2008a; 2006a). Part of the contribution of this study to science education is an understanding of the worldviews which inform the knowledge of the community of Mqatsheni in KwaZulu-Natal, and how these worldviews relate with school science. Understanding these relationships will inform local level science teaching and learning through facilitating a better understanding of how the students in Mqatsheni learn.

3.4.2 Worldview and learning

As noted earlier, our understanding of how students make sense of their natural world helps us understand how they learn. The quest for this understanding has seen research in science education evolve from an orientation towards behaviourism (associated with research into drill, practice, and transmission of facts); through personal constructivism (e.g. research into misconceptions); to social constructivism (where students' social worlds are understood to influence their conceptions of the natural world). Summaries of these orientations can be found in, for instance, Aikenhead (1996) and Cobern (1993). Aikenhead (1996) shows how social constructivism is extended further when the worldviews that students possess are considered.

Our worldviews are believed to shape our perceptions and ways of creating knowledge (Keane, 2008a). This especially affects the learning of science. Science education research has shown that the presuppositions a person has of what the world is like form a basis for how he or she thinks about and understands phenomena in science classes (e.g. Cobern, 1991; 1996; Hansson & Lindahl, 2010). School science in many countries, including South Africa, is taught from a Western perspective, which is not necessarily the same as the perspective from which many of the learners operate. Science education research suggests that as a result of this Eurocentric orientation (of school science), non-Western learners experience difficulties in understanding science (e.g. Aikenhead, 1996; 2006b; Cameron, 2007; Jegede, 1995; Jegede & Okebukola, 1991). Learning theories such as cognitive border crossing (Aikenhead, 1996); collateral learning (Jegede, 1995); amalgamated cosmology theory (Ogunniyi & Ogawa, 2008)

and dialogical argumentation instruction (Ogunniyi, 2011) are attempts at explaining the process of negotiating the differences between school science and other knowledge systems, with their associated (and often incompatible) worldviews. Studying and documenting worldview in relation to science learning is an important step towards understanding the extent to which learners in a given context may be finding school science incompatible with their own worldviews. As Cobern (1993) explains, when students hold alternative cognitive frameworks, they may have 'misconceptions' about scientific knowledge, not because they do not understand, but because they do not believe. Studying students' beliefs and worldviews could help make these worldviews explicit, and could help both science education researchers and science teachers begin to think of appropriate ways teaching science.

In explaining the purpose of Life Sciences in the NCS, the South African national Department of Education makes reference to worldview: "Exploring indigenous knowledge systems related to science exposes learners to different worldviews and allows them to appreciate, compare and evaluate different scientific perspectives" (DOE, 2003, p. 9). The Department of Education here considers the integration of IKS and science as an opportunity for focusing on the affective dimension of science education, which is articulated through learner comparisons and evaluation of different knowledge perspectives. The underlying assumption here is that learners will be given the opportunity to verbalise their thoughts, which may not always be the case in the majority of schools, because teachers are anxious to 'complete the syllabuses'.

I have made understanding the worldview of the community of Mqatsheni an important component of this study. This has important implications for not only identifying IK content that could be used in the science classroom, but also in discovering the ways in which science could be taught and learnt in this context.

3.5 Indigenous Knowledge and School Science in 'Conversation'

Discussions about the recognition and inclusion of knowledge held by indigenous peoples are often raised at academic, political and community development forums. Reasons given for consideration of integrating IK and science education range from political redress and human rights considerations (e.g. Battiste, 2005; /Useb & Chennells, 2004 ; Kincheloe & Steinberg, 2008; Mushayikwa & Ogunniyi, 2011; Odora Hoppers, 2002a); cognitive and pedagogical reasons (e.g. Aikenhead, 1996; 2006b;

Battiste, 2005; Jegede, 1995; Kawagley, Norris-Tull & Norris-Tull, 1998; Ogunniyi, 2011) as well as conservation, sustainable use of biological diversity and sustainable development (Aubel, 2006; Battiste, 2005; Moyo, 2012). In education, science has attracted the greatest amount of academic discussion regarding indigenous knowledge.

IKS is a national priority in South Africa, and advocacy for it is driven by the Department of Science and Technology (DST). The DST places emphasis on efforts to document IK, on integrating that knowledge in education, and on the sharing of benefits with communities (Mosimege, 2005). The Department of Education has made the valuing of IKS mandatory in all learning areas, in line with the national constitution (DOE, 2003). In addition, the National Research Foundation gives priority to research in IKS. Research in IKS has also been promoted through the founding of journals such as *Indilinga: African Journal for Indigenous Knowledge Systems*, and research projects such as the Sciences-Indigenous Knowledge Systems (SIKS).

3.5.1 Perspectives regarding the place of IK in science education

The acknowledgement of the existence of multicultural societies and multicultural classrooms, and how cognitive frameworks different from that of science, accounts for the general consensus among science education researchers of the need to consider ways of knowing in addition to Western-oriented science in the classroom (see Cobern, 1993; Lawrenz & Grey, 1995; Richards, Conlin, Gupta & Elby, 2012). School science is closely aligned to Western culture, and is different in many ways to indigenous ways of knowing. Including Indigenous knowledge in the classroom is a step towards recognising diversity in ways of knowing, as well as recognising the value of Indigenous knowledges. Research suggests that indigenous knowledges throughout the world make significant contributions to knowledge diversity (Turnbull, 1997). Besides, IK constitutes students' prior knowledge and could be a useful resource for learning (Chinn, 2007; Malcolm, 2008).

As already indicated, science education researchers are in agreement about the need to value indigenous knowledges (e.g. Aikenhead, 2006; Corsiglia & Snively, 2000; El-Hani & Bandeira, 2008; Matthews, 1998; Siegel, 2002). However, researchers differ in perspective on how IK and science should relate. On the one hand are scholars who see 'science' in IK, and thus advocate for the expansion of the meaning of school science so that it is inclusive of the knowledge associated with other cultures (e.g. Aikenhead, 2006; Brayboy & Castagno, 2008; Jegede, 1995; Ogawa, 1995). Such an expansion, they argue, would contribute to the valuing of IK. These scholars see

'science' as present among indigenous peoples, hence we can, for instance, talk of *African science* (Emereole & Maripe, 2003; Jegede, 1995), *Japanese science* (Ogawa, 1995), or *Yupiaq science* (Kawagley et al, 1998). On the other hand, there are scholars who want the term 'science' reserved for the ways of knowing typical of Western modern science (e.g. Cobern & Loving, 2001; El-Hani & Bandeira, 2008; Siegel, 2002). These scholars argue against valuing IK through either conflating 'knowledge' and 'science', or calling IK 'science' as this only serves to give science a sort of epistemic superiority rather than show the true value of indigenous knowledges. I take the arguments put across by Cobern and Loving (2001); El-Hani and Bandeira, (2008), who note that IK and science are different ways of knowing and must be kept distinct in the classroom. The main advantage of this is that it will enable both knowledge systems to critique each other (Cobern & Loving, 2001).

Arguments from both sides are important and worthy of consideration, as long as we keep in mind the nature of Indigenous knowledge. As highlighted earlier, IK is more than theoretical knowledge. It includes views of reality which influence both thought and action. As a result, some literature emphasises method in addition to content in integrating IK and school science. This perspective of IK-science integration that goes beyond content has been used to develop culturally relevant curricula among Indigenous peoples in Northern Canada, (Aikenhead, 2001; Sutherland & Henning, 2009; Sutherland & Swayze, 2012). As already pointed out, much research on IK and science has been carried out in South Africa and elsewhere in world. In places, IK-based curricula have been designed and implemented (e.g. Aikenhead 2001a). Work in South Africa has not been done to the same extent as in Australia, Canada, New Zealand and the United States. A lot of the South African science education research in IK is from a constructivist framework (e.g. Cameron, 2007; Hewson, Javu & Holtman, 2009; Moji & Hattingh, 2008; Ogunniyi 2011). An important component of constructivism is the recognition of learners' prior knowledge in teaching (see Scott, Asoko, Driver & Emberton, 1994) even though prior knowledge is sometimes viewed as a hindrance to the acquisition of scientific knowledge - a view that led to the research on misconceptions. However, treating prior knowledge as misconceptions has been disputed as students' prior knowledge has also been seen as useful to their cognitive growth (Scott, Asoko, Driver, & Emberton, 1994; Smith, diSessa & Roschelle, 1993). IK is embedded in Indigenous students' prior knowledge. Identifying and making use of that knowledge for science learning could contribute to their understanding of science.

In the next section, I will present the specific ways in which researchers have dealt with the integration of IK and science.

3.5.2 IKS in the curriculum statements

At the beginning of this study in 2008, teaching and learning in the FET Phase[21] in South Africa was guided by the National Curriculum Statements (NCS). Learning was guided by a set of outcomes, in line with Outcomes-Based Education. This situation changed with further reform, and in 2011 the Curriculum and Assessment Policy Statement (CAPS) became the new guiding document. The CAPS document represents a significant shift away from OBE and focuses on subject content. In this section I present the position of the two documents regarding IKS, but I will only use the CAPS documents in relation to the findings in chapter 7 because CAPS has been in use since 2011.

The valuing of IKS in education is a principle that applies to all learning areas[22] through all phases of schooling. In the FET science subject statements, the inclusion of IKS is more specific and is included in some Learning Outcomes (LO). The opportunity for the integration of IKS and science lies within the context of Learning Outcome 3 of Life Sciences and Physical Sciences subject statements. I quote the LOs for the two learning areas below:

> **Life Sciences, Technology, Environment and Society**
>
> *The learner is able to demonstrate an understanding of the nature of science, the influence of ethics and biases in the Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society* (DOE, 2003, p. 12)

> **The Nature of Science and its Relationships to Technology, Society and the Environment**
>
> *The learner is able to identify and critically evaluate scientific knowledge claims and the impact of this knowledge on the quality of socio-economic, environmental and human development* (DOE, 2003, p. 14).

The inclusion of IKS is explicitly stated in LO 3 (Life Sciences). IK is viewed as having contributed to scientific innovations and "needs to be rediscovered for its value in the present day" (DOE, 2003:12). Indigenous knowledge is not explicitly in LO 3 for Physical Sciences. It is however implied in the reference to "alternative ways of thinking resulting in different knowledge systems which are increasingly interactive with Mainstream

[21] The last three years of schooling (Grades 10-12) that lead to the Senior Certificate Examinations.
[22] In the National Curriculum Statements subjects are called learning areas.

science" (pp.14). This lack of clarity can be problematic for teachers who may not see space for the inclusion of IK in Physical Sciences.

Support documents for the NCS do show an inclination towards a multicultural science education position. The Department of Education's description of scientific knowledge as tentative, socio-cultural and historical is consistent with Abd-El-Khalick, Bell & Lederman's (1998) assertions on the nature of science, and Turnbull's (1997) position on how knowledge is developed. However, IK is hardly reflected in the Subject Assessment Guidelines (SAG) (DOE, 2007) a problem that spills over to the actual assessment. Teacher participants in Mushayikwa & Ogunniyi's (2011) study raise concerns that the exam system ignores IKS.

The Curriculum and Assessment Policy Statement (CAPS) for Life Sciences reflects some revisions regarding IKS. IKS appears under the learning area's third specific aim – "appreciating and understanding the history, importance and applications of Life Sciences in society" (DBE, 2011a, p. 16). IKS is however not defined in the new documents, but explanations given under Specific Aim 3 are very informative:

> Learners must be exposed to the history of science and indigenous knowledge from other times and cultures/…/indigenous knowledge systems…have their origins in different worldviews. Learner should understand the different cultural contexts in which indigenous knowledge systems were developed/…/Examples of indigenous knowledge that are selected for study should, as far as possible, reflect different South African cultural groupings (DBE, 2011a, p. 16).

In the CAPS documents, IK is presented as neither static nor confined to *African* origins, and teachers are expected to look out for IK from different cultural groups - a task that is probably too much for teachers in multicultural settings to effectively carry out. However, that statement reflects greater orientation towards inclusivity on the part of curriculum planners. Like the NCS, the CAPS document also reflects a multicultural view of science education and a view of the production of scientific knowledge as on-going. An assumption that comes through Specific Aim 3 is that knowledge acquired in respect of this aim (including IK) "always relates to specific subject content" (p. 16) and is associated with cognitive rather than practical skills. This purely cognitive and representational view of IK is problematic because indigenous knowledge is not limited to the cognitive domain, but also includes performative knowledge, talents, practical skills and worldview. Limiting the classroom use of IK to only representational

knowledge is forcing it to fit the Western view, and emphasises the dichotomy between knowledge systems (Le Grange, 2008; Turnbull, 1997).

Through this study, I seek to contribute to the documentation of Indigenous knowledge in Mqatsheni community without limiting it to that which is consistent with school science. I argue that IK-science integration can benefit from understanding both the similarities and differences between the two knowledge systems.

3.5.3 Aspects of IK that could be used in science

As highlighted in the last section, the South African national curriculum documents do acknowledge the value of indigenous knowledges although there are problems regarding working definitions of the nature of IK. In principle the integration of IK in the teaching and learning of all learning areas is mandatory, but the challenge is in identifying the knowledge that could be included in science. An additional challenge stems from the nature of IK as local. While there may be components of IK that are common across different ethnic groups, there are likely to be variations dependent upon natural environments and social histories. The documentation of IK, while a key priority for the Department of Science and Technology (Mosimege, 2005), is not indicated as a priority for the Department of Education (now called the Department of Basic Education), yet documentation is central to the process of identifying which IK could be used in science classrooms. Over the years, science, technology and mathematics education researchers have made recommendations for the documentation of IK (e.g. Dekkers, 2005; Hewson, Javu & Holtman, 2009; Onwu & Mosimege, 2004), and Otulaja, Cameron & Msimanga (2011) emphasise that IK needs to be textualised to make it accessible to teachers.

In the current environment where there is little documentation of IK, decisions about what IK to use in the science classroom can be informed by discussions on the nature of indigenous knowledge and on lessons from both local and international IK-based science education research. Many studies suggest indigenous knowledge comes in the form of values (Aikenhead, 2001), technology (Kawagley et al, 1998; Maluleka, Wilkinson & Gumbo, 2006; Moji & Hattingh, 2008), games (Moji & Hattingh, 2008; Mosimege, 2003; Nxumalo & Semple, 2013); language (Barnhardt & Kawagley, 2005; Battiste, 2005; McKinley, 2005), and knowledge of the environment in general (Kawagley, Norris-Tull & Norris-Tull, 1998; Kawagley & Barnhardt, 1998); and plants and animals in particular (Hewson, Javu & Holtman, 2009; Keane, 2006a). In a study in rural KwaZulu-Natal (Keane, 2008a) identified the community held performative

knowledge in the form of history (both community and family histories), medicine, health and food, and expressions of worldview. Keane (2008a) drew up three broad categories of the expressions of indigenous knowledge which may contribute towards decisions on what IK to include in school science:

1. factual knowledge, such as community histories and understandings of the environment.
2. performative knowledge and values, including talents usually manifested in cultural practices.
3. ontological / philosophical representational knowledge, i.e. worldview. Worldview contains and is shaped by factual and performative knowledge (Keane, 2008:591).

These typologies are similar to the broad categories (of Traditional Ecological Knowledge and Wisdom - (TEKW) presented by Turner, Ignace & Ignace (2000), namely:

- Practices and strategies for resource sustainability,
- Philosophy and worldview, and
- Communication and exchange of knowledge and information.

Keane (2008a) and Turner, Ignace & Ignace (2000) acknowledge the complexity of these categories, and that they are not subject to simple characterisation.

Factual knowledge about nature and associated skills do not have a strong presence in many traditional communities anymore (Keane, 2006a). The representational knowledge may however still be present, and could be discovered through identifying and documenting participants' worldviews. An awareness of the worldviews informing students' knowledge could be helpful in identifying ways of including IK in school science. Such an approach extends the boundaries of what IK can be included in science education, and indeed, perhaps the less transient aspects of IK.

3.5.4 IK and science integration

While a consideration of the relationship between IK and science are of great importance in the process of classroom integration, that relationship alone is not adequate. Of even greater importance is the broader view of the relationship of science and the socio-cultural world, also explained in Aikenhead (1996) and Cobern (1998). Science knowledge does not exist in a social vacuum. It exists within a socio-cultural world, and hence science education has to pay attention to the cultural issues regarding knowledge. Recognition of culture in science education does not pose a threat to logic (Cameron, 2007). Although science content does not change with cultural context, its

communication (as in science education) is culturally embedded (Cobern, 1998). Knowledge (including science knowledge) is a social construction. Science education in a non-Western cultural context is a cross-cultural activity, from the culture of science to the culture of the learners (Aikenhead, 2001b; Jegede, 1995).

The learners' socio-cultural context is therefore widely accepted as having influence on learning (Aikenhead, 1996; Hildebrand, 2007; Jegede, 1995). There have been calls for the inclusion of a "broader spectrum of voices" in science curriculum design (Hildebrand, 2007:46); culturally relevant pedagogy (Meyer and Crawford, 2011); focus on socio-scientific issues (SSI) (Hodson, 2010), and learner-centredness (Malcolm, 2008a; 2008b). IK-science integration could draw on all these in a way that extends the discussion beyond classroom boundaries to communities where IK originates.

The integration of IK and school science has been seen to succeed where there is careful planning and participative collaboration with knowledge holders in communities around schools. Such curricula have been designed and implemented in, for example, Canada (Aikenhead 2001b); Alaska (Kawagley, Norris-Tull and Norris-Tull, 1998); New Zealand (McKinley, 2005). The approach used in these projects is one where school science is taught in a way that is consistent with the students' socio-cultural world, particularly community values. Communities are involved in making decisions about the content and values that the students learn (Hildebrand, 2007). In keeping with the practices in traditional communities, the Elders teach local content to both local teachers and students (Aikenhead, 2001a). Local languages play a significant role, both in making the local knowledge accessible (McKinley, 2005) and in affirming the identities of local communities (Martínez, 2011). Science in these projects is taught in a way that does not discredit students' indigenous knowledge and identities.

There have been calls for values education even outside of IK-science education. Australia is one such country where there has been strong emphasis on values. Education that is founded on values seeks to develop in the students a sense of responsibility and concern for the individual as well as for the common good, and also reinforce interrelationships and interdependence (Hill, 2004; Scalfino, 2005).

Many benefits have been identified for adopting socio-cultural approaches to IK and science integration. The approaches go beyond identifying science-like content to including IK-related values. The inclusion of values helps students to 'smoothly' cross borders into and out of school science (Aikenhead, 1996), and nurtures and expands

their identities, preparing them for proficient living in both the indigenous and the scientific worlds (Aikenhead, 2006b). Cross-cultural science education gives room for communities to make decisions about what is to be learnt. Sometimes teachers get to learn IK together with their students, thereby modelling life-long learning (Aikenhead, 2001a; 2001b). Cross-cultural science education is about creating an environment that enables the participation of the 'other' knowledge system. It involves immersion in the local knowledge system, taking care to give the values and methods a legitimate place in the curriculum. Therefore, IK and science integration has to be thought of holistically, including both content and method. Science education research in South Africa has yet to explore this manner of community-based engagement between IK and school science in both research and science teaching and learning. My study contributes towards this holistic approach by engaging the community in identifying IK and worldview, as well as getting the community perspective of what can be used in schools and how.

Research reports from different South African contexts point to increased excitement and participation from students when IKS is incorporated in science learning (e.g. Brown Muzirambi & Pabale, 2006; Cameron, 2007; Manzini, 2006). Greater student interest and a more positive attitude towards science are also reported in Aikenhead (2001b) and Jegede & Okebukola (1991). Similar benefits are reported among teacher professional development programmes (e.g. Hewson, Javu & Holtman, 2009; Hewson & Ogunniyi, 2011; Ogunniyi, 2011). From a pedagogic dimension, cross-cultural teaching brings greater disciplinary integration (Kawagley *et al*, 1998); which is a point of importance in South African curriculum documents. Research findings from the South African context show that conflicting knowledge systems do not hinder students' desire to learn science so long as their beliefs are given a place in the classroom (e.g. Cameron, 2007; Manzini, 2006).

South Africa is a diverse country, and different communities may hold different values, which may sometimes be a problem. However, this plurality may be used as a resource in education. The denial of such plurality may negatively affect science teaching and learning through the use of teaching approaches that encourage assimilation (Aikenhead, 1996). Acknowledgement of a plural cultural heritage translates to diversity of values (Hildebrand, 2007), and science curriculum needs not be a contest of values, purposes and interests (Fensham 2010), but a space where diversity can be celebrated (Keane, 2006b, 2008a; Odora Hoppers, 2002a; Webb, Ogunniyi, Sadeck, Rochford,

Dlamini, & Mosimege, 2006). Western science and technology stand to benefit from this diversity (Aikenhead, 2006a; International Council for Science, 2002).

In many schools in South Africa, IK and science integration has been largely left to the discretion of teachers (Moyo, 2011), who have been given very little, if any support at all. Structured efforts at integration have come through postgraduate in-service professional development programmes for teachers. Attempts at integration are much smaller in scale compared to the projects in the Americas, Australia and New Zealand, and in most cases involve a single teacher and a class (e.g. Manzini, 2006; Brown, Muzirambi & Pabale, 2006). The larger-scale studies have been in the form of teacher professional development programmes at universities. An outstanding example is the Science and Indigenous Knowledge Systems (SIKS) project at the University of Western Cape (see Hewson & Ogunniyi, 2011; Kwofie & Ogunniyi, 2011; Mushayikwa & Ogunniyi, 2011; Ogunniyi, 2006; Ogunniyi & Hewson, 2008). The SIKS project focuses on using argumentation to facilitate IK and science integration. The authors of the project report greater sensitivity by teachers to learners' socio-cultural environments and a better understanding and acceptance of IK as a valid system of thought (Ogunniyi, 2007a; 2007b).

Attempts at IK and science integration through the SIKS project have been classroom-bound. The project recognises and recommends teachers' understanding of both the nature of science and the nature of IK as preconditions for effective integration. SIKS also recommends long-term mentoring of teachers through "dialogue, argumentation, role modelling and explicitly reflective instructional approaches" (Ogunniyi & Ogawa, 2008:183). However, the effectiveness of the approach may be constrained by its limited engagement with communities in which IK is held. Research in IK-science education requires participatory involvement of communities so that the research outcomes in terms of the knowledge, practices and values are from the perspectives of the participants.

There is promise for IK and science integration in South African contexts. Research reports community Elders as willing to work together with schools, and teachers as also willing to learn IK (Hewson, Javu & Holtman, 2009; Keane, 2006a). In addition, community participants are reported to be willing to identify the forms of knowledge they would prefer for inclusion in school teaching and learning (Webb, 2013).

The literature therefore envisions IK-science integration that is not confined to the classroom. Meaningful integration recognises the nature of IK as holistic and value-laden, inclusive of the language of the students, incorporating outdoor work and learning in the natural setting (Aikenhead, 2001b; Ogunniyi & Ogawa, 2008). In this way science learning becomes both multi-disciplinary and multi-sensory (Kawagley & Barnhardt, 1998). IK and science integration presents more than a pedagogical process. It is laden with issues of research approaches through which the IK can be identified. Both the processes of identification of IK and its integration with science become more meaningful for local communities when the processes involve power devolution and sharing (Khupe & Keane, 2010). A lot of South African research has focused on the pedagogical aspects of integration and have not emphasised the research aspects. The effectiveness of the process of identifying IK hinges on the extent to which research methodology is aligned to, and is sensitive to the worldviews of participants (Chilisa, 2012; Odora Hoppers, 2002a; Smith, 1999). This study is designed with emerging participative and indigenous methodologies in mind.

3.5.5 Challenges of integration

Despite the benefits discussed, the integration of IK and science in the classroom is not without challenges. Even in contexts where cross-cultural science teaching has been institutionalised, IK is sometimes ignored at least in part due to 'overload' of the traditional curriculum (Battiste, 2005; McKinley, 2005). Differences in the language of modern science and that of IK also present challenges which are further complicated by little representation of indigenous voice among curriculum decision makers (Reis & Ng-A-Fook, 2010).

In the South African context, baggage from the segregatory policies of South Africa's past education eras may pose as challenges to the valuing of Indigenous knowledge as it may be erroneously perceived as intended to keep Black people in subordinate positions. This misunderstanding may be strengthened by the NCS's conception of IK as only belonging to Africans, and may defeat the pedagogical relevance of the inclusion of IK. A portrayal of IK as old knowledge may also cause problems in acceptance of IK by both educators and learners as it will be seen as largely irrelevant in a global economic climate. Therefore, there is a need to 'realign' the conception of IK at curriculum planning level.

Little uptake of IK by teachers may also be the result of the multiple dimensions of curriculum reforms imposing too many (immediate) demands on teachers with too little

guidance. Dekkers's (2005), participants reported they would have probably integrated indigenous knowledge and technology (IKT) and science "*if they had known how to do it"* (p. 180, emphasis in the original). Moreover "teachers (and teacher educators) are not equipped to design a curriculum that integrates IKT and science in the intended way" (Dekkers, 2005, p. 180). Because of the absence of guidelines for the integration of Indigenous Knowledge Systems in teaching and learning, schools, districts and provincial authorities are not prepared to implement IKS (Mushayikwa & Ogunniyi, 2011; Naidoo, 2007). Lack of consistency of position by the Department of Education regarding IK in the curriculum documents (see Gundry & Cameron, 2008), adds to the list of challenges. Besides, IK is barely included in science assessment (Mushayikwa & Ogunniyi, 2011), which defeats the purpose of the inclusion of IK intended in the curriculum documents. Over and above all these, IK in South Africa is barely documented, so the teacher has few sources to draw from (Otulaja, Cameron & Msimanga, 2011).

3.6 Summary

The purpose of this chapter was to review the literature that tackles issues related to Indigenous knowledge and science integration. There are no common criteria for identifying who qualifies as 'indigenous' and what counts as 'knowledge'. The literature highlights a divergence of views regarding the definition of indigenous knowledge, and from these views I have distilled a definition for this study. I have argued for the cross-cultural approach to IK-science integration and have highlighted benefits and challenges as they relate to the South African context. In the next chapter, I discuss the research framework that guides this study.

CHAPTER FOUR

RESEARCH FRAMEWORK

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CHAPTER FOUR

RESEARCH FRAMEWORK

4.1 Introduction

In my first chapter, I outlined the purpose of this study as identifying the knowledge and worldview of the people of Mqatsheni for possible use in school science. In chapter 2, I explained the socio-economic, political and geographical context in which the study occurred, and in chapter 3 I presented research done on IK and science education, and how they informed my study. In this chapter I present the research framework that I used for this study. I draw on *ubuntu*, the indigenous research paradigm and socio-cultural theory to formulate an integrative research framework.

My research questions (section 1.3.3) are inseparable from issues of power in the research domain. To arrive at answers to these research questions, I first had to resolve issues like: What is knowledge? What knowledge can be described as 'indigenous'? Who decides what knowledge is and what it is not? Whose worldview matters? By what criteria (and whose criteria) should what IK to include in school science be determined? In whose framework are the criteria based? For what purpose and in whose interest is this integration? These questions do not have simple answers. Besides, any answers would be dependent on the respondent's epistemology. My ways of thinking were influenced by and also influenced the data collection process: both *how* and *with who* (from who) I collected the data. This in turn influenced decisions on the recommendations on IK and science integration.

Theories in IK-science education research are usually based on theories of learning developed from the cross-cultural perspective. According to this view, for most students, the transition from their life-world into the science classroom is a cross-cultural experience (Aikenhead and Jegede, 1999). It is from this perspective that theories like

cultural border crossing (Aikenhead, 1996); contiguity argumentation theory (Ogunniyi, 2007a; 2007b; 1997) and collateral learning (Jegede, 1995) have emerged.

My study focused on identifying Indigenous knowledge in Mqatsheni and on understanding and interpreting the participants' worldview in relation to decisions about what knowledge to include in school science and how. My study was not classroom-based, but rather community-based. The study could then serve to inform IK-science integration at classroom level. Consequently, I needed to develop a framework that adequately addressed my research questions. This framework would need to guide me through the research process, from data collection, analysis and interpretation, as well as through reporting the findings. However, I did not find any in the science education literature that met with my research purposes and needs. Considering that my object of study was Indigenous knowledge, it was sensible for the study, as suggested by Keane's work (2006a), to be informed by the participants' own frameworks (Keane, 2006a). I needed a framework that would be consistent with an Indigenous research paradigm (McIvor, 2010; Wilson, 2001).

Since the publication of Linda Smith's *Decolonising Methodologies: Research and Indigenous Peoples* in 1999, there has been an increase in both advocacy and use of methodologies that are sensitive to the lives and cultures of Indigenous People (e.g. Chilisa, 2012; Louis, 2007; Moloi, 2013; Mutua & Swadener, 2004; Odora Hoppers, 2002a). Much research had hitherto been done *on* indigenous peoples and their knowledge and practices, but not much of it was in the framework of the indigenous peoples, and true to their methodologies (Smith, 1999). Questions have been raised (for example by; Chilisa, 2012; Mutua & Swadener, 2004 and Odora Hoppers, 2002) on the adequacy and inclusivity of mainstream research methodologies in dealing with 'other' knowledge systems. Carrying out studies with Indigenous peoples in ways that acknowledge their knowledge and experiences is a way of esteeming both the people and their ways of knowing. I thus consider it very significant that the principles of the South African curriculum focus on *valuing* Indigenous knowledge systems and not simply including them in education. My study represents efforts at valuing indigenous knowledge in both science education research and in science education. I am aware that by the process and product of this research study, I am involved in a 'Western' style of study of Indigenous knowledge. However, as emphasised by Gardiner (2007), my approach in this study has been to approach the participants "in ways that acknowledge their experience, their expertise… and the history and aspirations" (Gardiner, 2007 p. 2).

My assumptions about knowledge production, transmission and utilisation have significantly contributed to my choice of frameworks. The first of my assumptions is that knowledge production, transmission and utilisation are social activities (Turnbull, 1997). In my study, the processes of data collection and interpretation were key knowledge production activities, and hence they needed to be interactive and to be carried out in ways that encouraged participant involvement. Secondly, I believe that knowledge cannot be separated from the knower (Marton & Fai, 1999; Prosser & Trigwell, 1999). I believed that what the people of Mqatsheni knew was informed by their experiences and histories. Thirdly, I believe that knowledge is transactional and therefore not static, but changes both spatially and temporally (Turnbull, 1997), hence any people's 'Indigenous' knowledge is likely to have been influenced by other knowledge systems over time. Fourthly, I believe that knowledge is not neutral, but that it is an instrument of power and privilege (Reason, 1998). These assumptions about knowledge influenced the processes of collection and analysis of data through shaping decisions on *what* methods and instruments to use, and also *how* the different methods and instruments were administered.

In addition to the assumptions outlined above, the context of my study area played an important part in reaching decisions about the research framework. Mqatsheni is nine road hours away from my university, which is located in Johannesburg, the largest city in South Africa - a city regarded as a place of social, economic and cultural privilege and power. Its Zulu name is "*eGoli"*, meaning "the city of gold". Since the discovery of the precious metal almost a century ago, many from all over Southern Africa, including Mqatsheni, have longed to set foot in Johannesburg. From the beginning of this study, I was mindful of the power imbalances that could result from the unequal economic and educational status of Johannesburg and Mqatsheni, and of the school and the University of the Witwatersrand. Research in materially marginalised communities cannot be separated from the social realities the communities face, and this blurs the boundaries between research and development. Khuphuka, the NGO through which we negotiated access into Mqatsheni, offered the community clear benefits in terms of its HIV/AIDS-related work. Participants asked early in the study how they would benefit from educational research (Khupe and Keane, 2010). There was no clear-cut answer to that question. The study was neither aimed at bringing solutions from outside, nor was it just about producing knowledge for its own sake. It was rather, about creating a democratic environment where the community are co-creators of the research agenda as well as the action that would address their needs (Malcolm, Gopal, Keane, & Kyle, 2009). Besides, the study was about indigenous knowledge. It was about creating

spaces for alternative ways of knowing that would not normally be included in science. Therefore, it was only appropriate that research into such knowledge be in ways that are consistent with the Indigenous knowledge framework (Chilisa, 2012; Louis, 2007; Smith, 1999), implying that the study had to unfold in ways that are both relevant and sensitive to the context.

From the beginning I targeted building relationships with the community to ensure smooth entry and stay, as well as smooth exit. It is for this reason that I found it most appropriate to approach the study from an Indigenous knowledge paradigm (Odora Hopper, 2002a; Smith, 1999), using the framework of *ubuntu* (Swanson, 2007). I then chose transformative participatory research as the design most consistent with Indigenous knowledge research and ubuntu. I now present the frameworks and the collective role they played in the context of the study.

4.2 Ubuntu

The term *ubuntu* is probably just as old as many of the African languages, but its use in academic discourse is very recent. Academic work on *ubuntu* features mostly in philosophy and philosophy of education, where its value in education and life in general has been highlighted (e.g. Broodryk, 2006; Metz, 2007). *Ubuntu* is also seen as having immense value in healing South Africa's divided past (Louw, 2004; Venter, 2004) and even in enhancing human capability (Le Grange, 2012). Although suggestions to use *ubuntu* as a research framework are also becoming common (e.g. Keane, 2006a; Muwanga-Zake, 2009; Swanson, 2007), u*buntu* is yet to be established in science education research.

4.2.1 What is ubuntu?

Ubuntu is the Nguni[23] version of a concept that occurs in many Southern African languages. It is known as '*botho'* in Sotho/Tswana, '*unhu'* in Shona, '*bunu'* in Kalanga and Tsonga, '*umunthu'* Chewa, and '*vhutu'* in Venda. It means: 'being human' or 'humanness' (Mdluli, 1987) or personhood (Letseka, 2013). It is a philosophy that not only promotes the common good of society (Venter, 2004) but is also a way of understanding reality (Broodryk, 2006). While the concept appears to be uniquely African, *ubuntu*-related qualities exist in non-African communities, for instance, among Australian Aborigines (Morgan, 1987). It is my opinion that *ubuntu* is a feature of

[23] Nguni is the collective term for some Southern African tribes and languages. The languages are isiNdebele, siSwati; isiXhosa and isiZulu.

traditional societies, but has persistently faced erosion from modernisation, which often carries with it secularization, rapid urbanisation, individualism and materialism (Khupe, Cameron and Keane, 2010). The principles of ubuntu are part of the fabric of rural communities (notwithstanding the fraying of the fabric at times). These principles include: respect, communalism, interdependence, supportiveness, solidarity, cooperation, caring for others, kindness, neighbourly support and participation for the common good (Hamminga, 2005; Malcolm & Alant, 2004; Louw, 2004). *Ubuntu* is the basis of the African worldview (Broodryk, 2006).

Ubuntu is used to express 'humanness' or 'being human' (Mdluli, 1987). Placing emphasis on relationships and promotion of the good of society (Venter, 2004), *ubuntu* is "…a philosophy that sees human needs, interests and dignity as of fundamental importance and concern" (Higgs, 2008:452). *Ubuntu* is underpinned by a concern for the welfare of others, manifesting through among others, respect, communalism, kindness, generosity, honesty, caring for others, and participation for the common good (Hamminga, 2005). *Ubuntu* is an important aspect of the African worldview (Venter, 2004). It affirms the humanity of the individual in direct relation with fellow humans, and it carries positive connotations of fostering and manifesting qualities of kindness and neighbourly support (Louw, 2004).

Ubuntu is most clearly expressed in the Zulu/Xhosa maxim, *umuntu ngumuntu ngabantu* (a person is a person through other persons), and could be the same concept that Mbiti (1969) characterises as 'kinship'. The individual does not exist in isolation, but in a web of relationships with others. Mbiti (1969) expresses it thus:

> Only in terms of other people does the individual become conscious of his own being, his own duties, his privileges and responsibilities towards himself and other people...Whatever happens to the individual happens to the whole group, and whatever happens to the whole group happens to the individual. The individual can only say: 'I am, because we are; and since we are, therefore I am'. This is a cardinal point in the understanding of the African view of man (Mbiti, 1969:106).

Ubuntu is both a rule of conduct and social ethic (Louw, 2004). It prescribes desirable and [communally] acceptable forms of human conduct, and this includes how they should relate (Letseka, 2013; Louw, 2006). *Ubuntu* emphasises collective solidarity, encouraging the understanding the self primarily in relation to others, not as 'independent' of others (Kamwangamalu, 1999). Individualism is foreign to ubuntu. It is rather communalism that is encouraged.

Ubuntu is regarded as something special in Africa, and is understood to be an ideal, that is why a person can be described as 'having *ubuntu'* or negatively described as 'not having *ubuntu*'. *Ubuntu* is not an inborn quality, nor is it eternally present within the individual. It is a value that the family and greater community have the responsibility to cultivate in children. As the individual grows, it gradually becomes their own responsibility to live up to the communally acceptable and desirable ethical standards throughout life. The persistence of politically-motivated and crime-related violence across the African continent are suggestive of the values of *ubuntu* being eroded (Letseka, 2013). The pervasive evidence of loss of *ubuntu* in South African society has led to calls for education that draws on *ubuntu* (Letseka, 2013).

Although the human-ness expressed in ubuntu appears to be separate from religion, Mbiti (1969) describes Africans as notoriously religious and hence, the boundary between African secular and religious life is blurred.

4.2.2 Ubuntu and research – "I am because we are"

The application of *ubuntu* in research comes from the growing need for research oriented towards social justice, research that gives space to the democratic, egalitarian and ethical engagement of participants (Swanson, 2007). In this study, my application of u*buntu* has a double significance. I draw on *ubuntu* both as an ethical framework, and as a way of knowing. *Ubuntu* places strong emphasis on values and relationships. Studies in South Africa have shown *ubuntu* to be consonant with the worldview of many Black participants (e.g. Malcolm & Alant, 2004; Muwanga-Zake, 2009), and as having potential to form a valuable framework for both education and education research (Venter, 2004). I chose to ground my study in *ubuntu* so that I could establish strong, respectful relationships with participants and interact with them in a more relational way. I wanted to research 'with' the participants and not 'on' them (Reason, 1998). My experiences in Mqatsheni in many ways confirmed the importance of focusing on relationships. During the many times I walked through the village, I was greeted by everyone I met, children and adults alike – very much unlike in the city. I was addressed as "*mtanami*" (my child) by most of the Elders, which made me feel I belonged to everyone. I also addressed them as "my parents". I was "sis Constance" to the young people who worked at Khuphuka. I was thus not just a researcher; I was one of their relations.

I drew on my own background of *ubuntu* to negotiate entry into Mqatsheni. In many cases, it was not only logical, but it was also necessary to go further than the stipulations of university ethics protocols (Chilisa, 2012; Keane, 2008a). For instance, the written permission from the KZN Department of Education was not all that was needed to request the school to participate. It was also important to take cognizance of local authority structures and protocols, and request permission from the traditional authorities. I applied *ubuntu* in making decisions on language of communication; in developing relationships with participants outside the scheduled appointments, for example, calling to inquire after a participant's wellbeing and in some cases, their studies; visiting a bereaved family; or collecting materials that could be useful for teaching and learning. Therefore, *ubuntu* calls for great researcher responsibility during fieldwork and even during reporting. It demands sensitivity towards the participants regarding their context. Grounding my study in *ubuntu* made me realise more and more that "I am because we are" (Mbiti, 1969:141).

Since ubuntu is an Indigenous African value, framing my study in ubuntu meant working in an Indigenous research paradigm. The two cannot be thought of apart from each other because they are like two sides of the same coin. I discuss the Indigenous research paradigm in the next section.

4.3 An Indigenous Research Paradigm

In the past, research among indigenous communities has often been intertwined with colonialism and imperialism, most of whose methodologies have been condemned as denigrating of indigenous peoples and their ways of being (Odora Hoppers, 2002a; Smith, 1999). Mainstream methodologies usually align with a top-down research paradigm that serves to portray the worldview of the researchers at the expense of those of the communities that they study (Chilisa, 2012). Indigenous ways of being do not always fit this dominant knowledge framework (Louis, 2007). In recent years, there has been rising interest across disciplines (both globally and in South Africa), in the recognition of indigenous knowledges and ways of living, but there still has to be more decisive shifts away from inquiry that is based on the mainstream frameworks (McIvor, 2010; Odora Hoppers, 2002a; Wilson, 2001). Such a shift is leading to indigenous research paradigms (Smith, 1999; Wilson, 2001) and which, in the African context, some scholars prefer to call the 'Afrocentric paradigm' (e.g. Mkabela, 2005; Owusu-Ansah & Mji, 2013).

A paradigm is a set of beliefs that together guide actions, and in the case of research, those beliefs guide actions on how to carry out the research (Wilson, 2001). Wilson views a research paradigm as having four constituent elements: our beliefs about reality (ontology); how we think about reality (epistemology); how we use our ways of thinking to gain more knowledge about reality (methodology); and a set of morals or ethics (axiology). The methodologies we employ in research show how we use our ways of thinking (epistemology) to gain knowledge about our reality (ontology). For a research study to fit within the indigenous paradigm, it must be guided by the assumptions of that paradigm, and must relate to indigenous methodologies and indigenous ethical practices.

This emphasis on indigenous methodologies is not to be construed as a rejection of mainstream research methods. It is rather about understanding and carrying out research from the perspective of peoples whose ways of knowing were previously marginalised and placing due regard on cultural protocols and values as an integral part of the methodology (Smith, 1999). According to Smith, these values, beliefs and customary practices of indigenous communities are

> …'factors' to be built into the research explicitly, to be thought about reflexively, to be declared openly as part of the research design, to be discussed as part of the final results of a study and to be disseminated back to the people in culturally appropriate ways and in a language that can be understood (Smith, 1999, p. 15).

The shift towards indigenous methodologies therefore comes with recognition of the importance of respectful and ethically sound relationships with participating communities (Louis, 2007), resulting in researchers purposively setting out to work in ways that acknowledge participants' traditional teachings and their spiritual connections.

An indigenous paradigm views relationships as central to the research process, thus knowledge and people are not seen as 'objects' (Louis, 2007; Wilson, 2001). Louis (2007) synthesises four important principles of indigenous methodologies (Figure 4.1). Firstly, *relational accountability* describes the network of relationships indigenous peoples have with both their social and physical worlds. In the field, the researcher is not only responsible for developing relationships, but is accountable to all these relations. Where relationships with participating communities have been appropriately established, they can last beyond the duration of the study (McIvor, 2010). According to Wilson (2001), as a researcher, you are

> ... answering to *all your relations* when you are doing the research. You are not answering questions of validity or reliability or making judgements of better or worse…you are asking how am I fulfilling my role in this relationship? What are my obligations in this relationship? The axiology or morals need to be an integral part of the methodology so that when I am gaining knowledge, I am not just gaining in some abstract pursuit; I am gaining knowledge in order to fulfil my end of the research relationship (Wilson, 2001, p. 177, emphasis in the original).

The shift away from questions of validity and reliability suggested by Wilson (2001) should not be interpreted as rendering research in an indigenous paradigm as wanting in rigour. Rather, when issues of relational accountability are properly handled, appropriate methods will be used which will increase the authenticity and trustworthiness of the research (Guba & Lincoln, 2005).

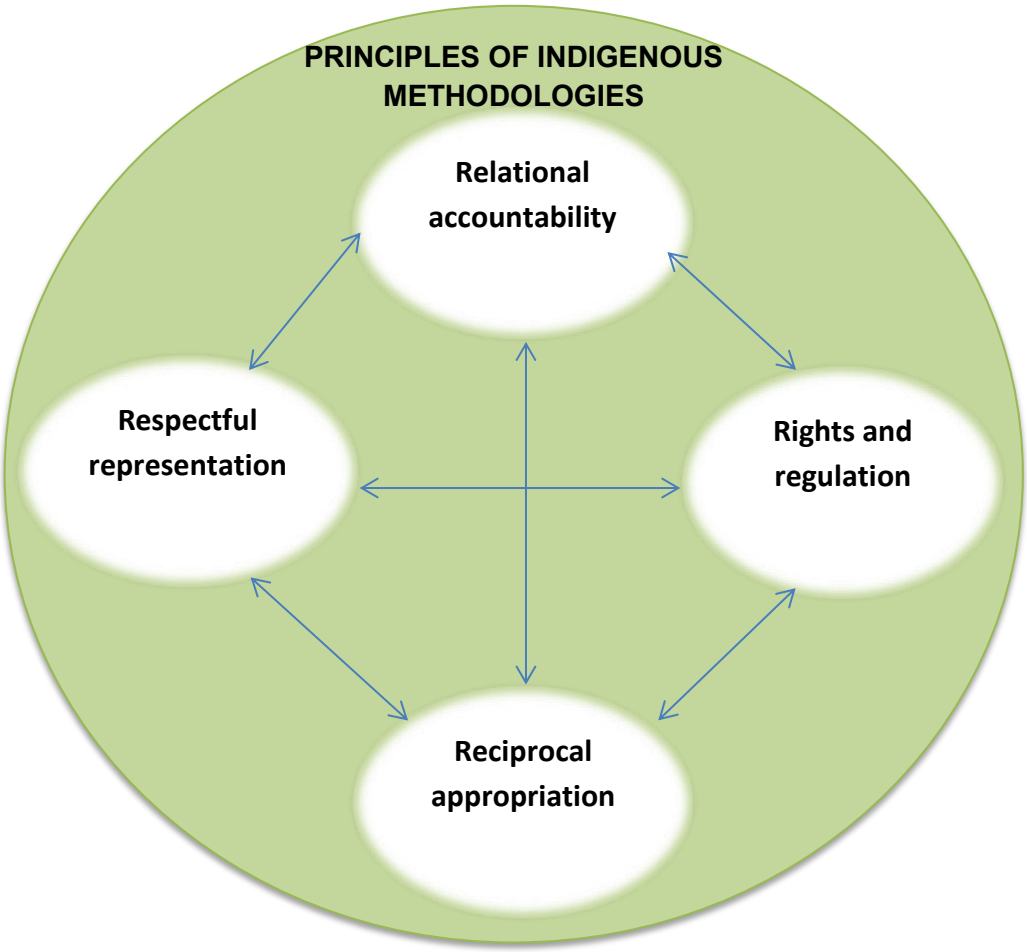


Figure 4.1: Principles of indigenous methodologies (adapted from Louis, 2007)

The second principle is *respectful representation*. With regards to this principle the researcher thinks about how she represents herself and community participants, the events and phenomena in the study. Louis (2007) cautions:

> Respect is not just about saying 'please' or 'thank you'. It's about listening intently to others' ideas and not insisting that your ideas prevail … It's about displaying characteristics of humility, generosity, and patience…(Louis, 2007, p. 133).

The focus on respectful relationships characteristic of indigenous methodologies makes the researcher aim to avoid misrepresenting and misinterpreting participants. The researcher has the ethical responsibility to be judicious about what knowledge can be shared with the general audience.

The third principle is about *reciprocal appropriation*, and comes from recognition that research within the social domain essentially involves appropriation, and thus requires that the process benefits all involved. What this implies on the part of the researcher is the need for continual feedback to stakeholders, and consulting with them on how to make the process beneficial for everyone. Even when the study is done, it is the researcher's ethical responsibility to report back and share knowledge with those who helped make it (Smith, 1999). Reporting back the findings also helps to maintain relationships with participants as suggested by McIvor (2010).

Rights and regulation require an understanding that the study centres on local cultural protocols. The community participants own the knowledge that they share; hence the research process should be collaborative, proceeding in a manner that is reflective of a balance of power among university and community researchers.

In this study, I see the principles of Indigenous methodologies not as separate entities within the research process. For this reason, I have used double arrows and soft edges in Figure 4.1 to illustrate how each principle influences the others throughout the research process. I view the four principles as serving an important purpose of reminding me of my ethical responsibilities throughout the study. The ethical considerations go way beyond the formal contracts and they are not externally generated in the same way university protocols are. Communities do have guidelines on how they expect researchers to relate with them. In some communities these guidelines are written down (Mosimege & Holtman, 2012), but in others (Mqatsheni included) they are not. Either way, awareness of researcher responsibility and a willingness to learn and observe these protocols is what matters. The ethics requirements brought about as a result of working in the frameworks of *ubuntu* and the indigenous paradigm are rigorous and seem to require even greater researcher accountability than mainstream research.

4.3.1 Ubuntu and IK methodology in Mqatsheni

Among the issues that influenced the choice of methodologies in this study were the largely oral culture of the participants; the place of the Zulu language as a vehicle of participants' culture; the importance of history as well as the place of Traditional Council. I drew from the principles of ubuntu to carry out collaborative research. The study proceeded in the participants' language of choice[24], because of an understanding that "language includes ways of knowing" (Battiste, 2008:504). In a country where English is so dominant, the use of isiZulu in this study contributed to the recognition of the local language as important as any other. It emerged as the study progressed that the use of isiZulu also contributed to rich sets of data from the students. Meetings with Elders were in their Traditional Council premises, where the meetings proceeded in the terms of the Elders and followed the traditional format: beginning with a song and prayer, and taking time to allow everyone to be heard. The meetings ended with sharing a meal. This allowed for the expression of participants' customary practices and spirituality. Although a research agenda had to be set prior to entry into the community (to fulfil university requirements), it was necessary to allow for participants' input, and adapting plans to suit local needs and conditions. Throughout the study, progress was discussed with the Elders, the principal and teachers. We collectively reviewed activities and made collaborative decisions on future plans. Based on suggestions by Louis (2007), we[25] agreed on an exit plan that included writing a summary of the findings in English and isiZulu, in a way that is accessible to participants.

Proceeding with the study in an indigenous paradigm placed heavy demands on time and finances. However, these costs did not outweigh the benefits of relationships developed, and learning for all participants over a two-year period. As relationships grew stronger, levels of trust increased and so did the willingness to participate. In addition, the study remained morally and logically aligned with the research purposes.

4.4 Integrating Indigenous and Mainstream Frameworks

Ubuntu and indigenous research (incorporating participative/collaborative research), constituted the methodological framework for this study. These frameworks helped in identifying the knowledge that the people of Mqatsheni have, and the worldview that underpins such knowledge (research questions 1 and 2). The knowledge worldviews

[24] The participants had a choice to either use their home language or isiZulu. The majority chose to use isiZulu.
[25] Both university and community participants.

were considered for integration with mainstream science (research question 3). The decisions about *what* local knowledge to use in school science and *how* to use it brings together different ways of knowing at both science education research and at science education levels. The integration happens in a context that is made unique by the interplay of social, historical and cultural factors, particularly applicable to this community, leading to the emergence of particular knowledge and understandings of reality negotiated through language. It thus becomes necessary to bring together the indigenous research paradigm and socio-cultural theory to form an integrative research framework (see Figure 4.2 on page 91). I will explain the framework later on in this section.

Socio-cultural theory has its roots in the field of educational psychology. The theory was developed by Lev Vygotsky, a Russian psychologist, in the early twentieth century. Vygotsky is considered the first modern psychologist to suggest mechanisms by which culture becomes a part of a person's nature (Vygotsky, 1978). The socio-cultural theory of higher mental processes is seen as an application of dialectical and historical materialism, which views all phenomena as historical, and as being processes in motion and in change (John-Steiner, 2007). The theory posits that "the mechanism of individual development change is rooted in society and culture" (Vygotsky, 1978, p. 7). Therefore, thought is not free from social and cultural influences. Vygotsky emphasised the role of speech in the development of thought processes. He believed humans use speech as a tool to master their surroundings.

Although developed as a theory of learning, and developing into what has now been popularised as social constructivism, the sociocultural perspective is applicable across disciplines, and can be useful in science education research in as much as it has been widely used in science education. Taking a sociocultural perspective means "viewing science, science education, and research on science education as human social activities conducted within institutional and cultural frameworks" (Lemke, 2001, p. 296). The theory is of particular importance in social research as it acknowledges change and evolution of knowledge in time and space. Understanding knowledge as changing and evolving is of particular significance for research in indigenous knowledge, which is sometimes misunderstood as old and static and ancient (Semali & Kincheloe, 1999). Like all other knowledge, IK is a product of social, historical and cultural influences (Turnbull, 1997). It is more accurate to view the knowledge as continuously evolving, subject to interaction with other knowledge systems.

4.5 An Integrative Research Framework

I have synthesised the frameworks presented above into a diagram (Figure 4.2). Ubuntu, indigenous methodologies and sociocultural theory guide the collaborative processes of data collection analysis and interpretation all the time emphasising the 'building blocks' indicated in the outer ''field', such as respectful relationships, consideration of context, managing expectations and the role of community Elders. It is through the continuous interplay of these building blocks during the data collection and analysis - all filtered through my own worldview - that I was able to understand the community knowledge and worldview. In Figure 4.2, the arrows represent the general progression of the research process from raw data to when decisions about integration can be made.

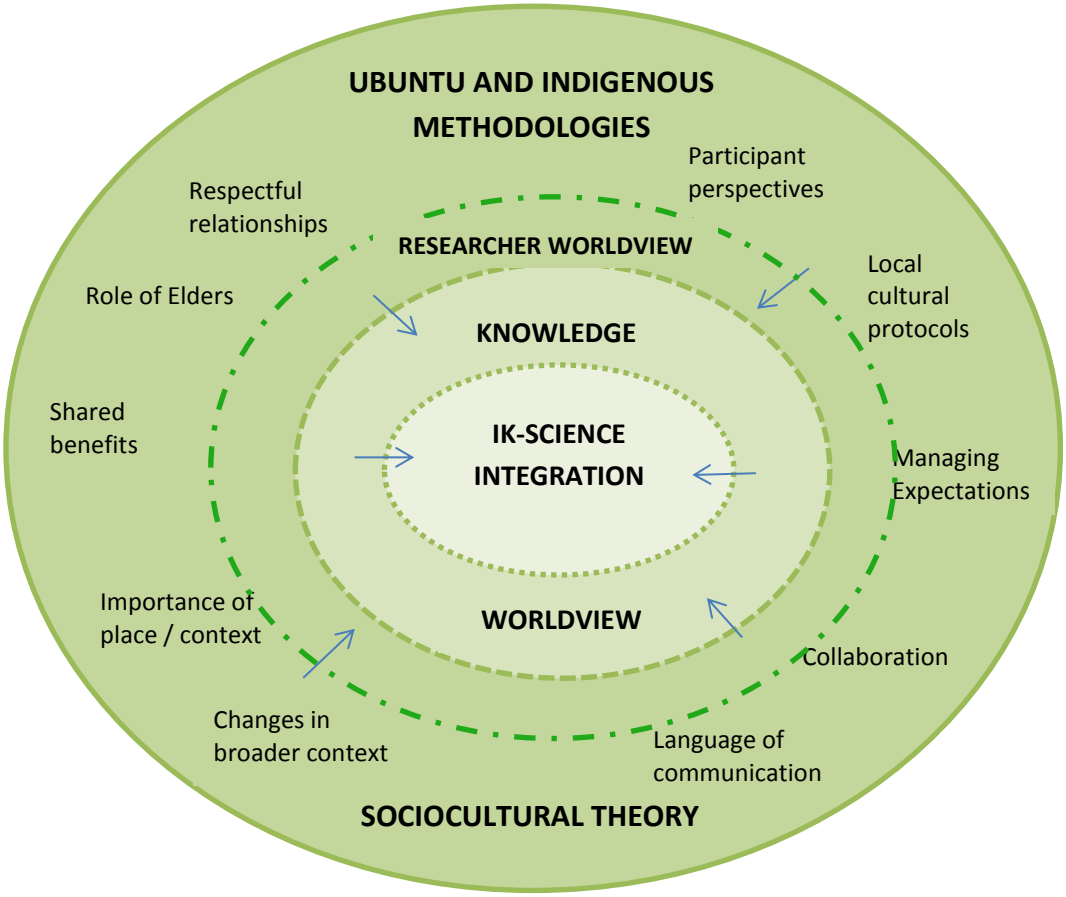


Figure 4.2: An integrative research framework

In developing this framework, I put into practice (from a research perspective) the integration of ideas form different perspectives. I acknowledge the contribution of my subjective selection and interpretation of data in determining what counts as knowledge, and what constitutes the worldview of the participants.

4.6 Summary

In this chapter, I outlined my assumptions on knowledge creation and dissemination as having played a key role in the construction of an integrative research framework. I drew on ubuntu to provide ethical guidance (Muwanga-Zake, 2009; Swanson, 2007; Venter, 2004) and buttressing for the indigenous research paradigm. I further drew on sociocultural theory for analysing data and to support the IK and science integration project. The resultant integrative research framework emphasises relationships as an important condition for research. Its contribution to research lies in its ability to bring together research purposes and methods, while ensuring a significant shift away from the dominant research paradigms.

In the next chapter, I outline the research design and methodology used in this study.

CHAPTER FIVE

RESEARCH DESIGN

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CHAPTER FIVE

RESEARCH DESIGN

5.1 Introduction

In chapter 4, I presented *ubuntu*, Indigenous methodology and sociocultural theory as the pillars of my study. I described how I constructed an integrative research framework to inform data collection, interpretation and analysis. The framework emphasises the saliency of context and respectful relationships. In this chapter, I build on that framework to describe the transformative participation and collaboration that took place during this study. I describe the research design, giving details of participants' roles and the forms of data that were generated. I then describe how I analysed the data.

5.2 Transformative Participatory Research (TPR)

As outlined in Chapter 1, the purposes of this study were to:

- identify 'Indigenous' knowledge and practices as well as the worldview that 'defines' the people of Mqatsheni in order to contribute towards documentation and creation of opportunities for the knowledge to be available for use in school science;
- create a repository of ways in which IK in Mqatsheni could be used in science teaching, thus contributing to a culturally-relevant curriculum; and
- contribute to transformation in Indigenous knowledge research by following methods that recognise Indigenous knowledges, practices and languages as valid and valuable.

These purposes influenced the orientation of this study towards transformation research, bringing together community and researchers in collaborative participation that is focused on increased social justice (Malcolm, Gopal, Keane & Kyle, 2009;

Mertens, Sullivan & Stace, 2013). Collaboration and mutual capacity building are the characteristic elements of transformative research. The research process can be designed to accommodate multiple methods, to be culturally respectful and supportive of diverse needs. For instance, Malcolm *et al*., (2009) ran collaborative science education research projects with rural communities, while Mertens, Sullivan & Stace (2013) report on studies done with people with disabilities. In transformative research, relationships between community and researcher participants are guided by the cultural protocols of the community participants. Some Indigenous communities have written protocols that serve to guide researchers (Battiste, 2008; Hornung, 2013; Mertens, Sullivan & Stace, 2013; Nicholls, 2009). Although there are no written protocols in Mqatsheni, I continually sought guidance from literature relating to research among indigenous communities, and also continually consulted with the Elders (through the secretary), teachers and research assistants.

The backgrounds, purposes and characteristics of transformative participatory research resonate with those for Indigenous methodologies (described in chapter 4). Both originate from a critical perspective (Smith, 1999; Mertens, Sullivan, & Stace, 2013). Both seek redress on power issues common between researcher and communities, and they both advocate for community perspectives to be acknowledged (Kincheloe & Steinberg, 2008). Both emphasise sensitivity to cultural context; fluidity of approach; knowledge sharing and collaboration; and for research to be linked to community needs (Battiste, 2008; Kincheloe & Steinberg, 2008; Smith, 1999). Research carried out within the Indigenous perspective is by nature transformative. Participatory research as described by Kemmis and McTaggart (2003) and Reason (1998) is a common methodology that can be appropriately inclined to both transformative and Indigenous research orientations, and collaboration in such studies is used as a vehicle for social transformation (Malcolm *et al*., 2009). Because of this intersection between transformative research and Indigenous methodologies, I saw it appropriate to use transformative participatory research as the methodology for this study.

TPR is based in participatory inquiry - an approach that acknowledges the knowledge and ways of life of research participants in marginalised communities as important for their own development. Participatory inquiry views participants' knowledge as also potentially important for everyone's development, for instance, in issues related to sustainable development (Malcolm *et al*., 2009; Kawagley Norris-Tull & Norris-Tull, 1998). The orientation is critical of a deficit attitude, where communities are seen as lacking, and researchers seeing themselves as having solutions to community problems

(see Gardiner, 2007). Transformative participatory research therefore suits the movement towards decolonising research methodologies (Mutua & Swadener, 2004; Smith, 1999) in that it seeks to avoid undesirable linkages between mainstream research and colonialism, where, based on the criteria of the researchers/colonisers, "they [researchers] came, they saw, they named, they claimed" (Smith, 1999, p. 80). Transformative participatory research acknowledges the relationship that exists between knowledge and power, and thus seeks a shared-power position between the university researchers and community participants, so that both groups are actively involved in the creation of knowledge. The approach seeks to place communities "at the centre of the knowledge creation process; to move people and their daily lived experiences…from the margins of epistemology to the centre" (Hall, 1992:15-16). It is within the objectives of research within a participatory framework to produce knowledge that is directly useful to the participants through the process of collaboration (Reason, 1998, p. 270). Reason advises participatory researchers to "honour the wisdom of the people" through promoting dialogue in a subject-subject relationship with the participants. Transformative participatory research takes a step further into community participation in that it has a community empowerment agenda (Malcolm, *et al*., 2009).

In carrying out this study, I envisaged a relationship with participants where all our contributions to the research process were valued. The success of the project depended on us (myself and all other participants) jointly sharing ownership and responsibility for the project (Keane, 2008b; Kemmis & McTaggart, 2003). For this reason, the majority of participants in this study are identifiable, and not anonymous. I had the responsibility to establish and develop long-term, respectful relationships because the quality of findings strongly depended on such relationships (Minkler, 2004). I had to continually confront the challenge of the socially entrenched power relations that usually exist between community and university participants. I had the greater responsibility of levelling the ground for mutual respect and learning. I had to be willing to learn from the community, and at the same time willing to share my own knowledge and experiences in a way that did not overlook or displace community knowledge (Moloi, 2013). I intended for any benefits from the study to be reciprocal. In the light of these intentions, I decided to use TPR as a methodology grounded in *ubuntu* and Indigenous research (as described chapter 4). TPR facilitates mutual learning for all involved, and is appropriately linked to a view of Indigenous knowledge as a process of 'coming to know'. As Dawn Sutherland puts it, 'coming to know'

> "…is the knowledge gained while trying to create something new out of a collective process that includes community, teachers and students. It is the value of having community members, teachers and students try to incorporate their own local experiences and knowledge while learning a Western science curriculum (in Malcolm, Sutherland & Keane, 2008, p. 615).

I will outline the contribution of each group of participants when I explain the data collection process later in this chapter.

Participatory inquiry is sometimes criticised for sacrificing rigour in its promotion of democratic processes (Kemmis & McTaggart, 2003). However, such criticism is based on perspectives that limit criteria for validity only on technical aspects of the research process. Equally important is a consideration of "what counts as good evidence in terms of what participants (using the evidence critically) think is accurate, relevant, appropriate and pertinent to their purposes" i.e. epistemology (Kemmis & McTaggart, 2003:375). I found the participants' perspective of what is relevant and appropriate particularly important for my study, where only some knowledge could be shared with outsiders. The Elders in this study pointed to knowledge holders who I could follow up on. They had the wisdom and experience to decide on what collective knowledge could be shared (Steinberg, 2008). The concept of "secret knowledge", although beyond the scope of this thesis, represents a significant difference between Indigenous and Western epistemologies. Secret knowledge is accepted and respected among Indigenous peoples, with the understanding that such knowledge is only revealed (mostly by ancestral spirits) to certain people and for particular purposes, and in many cases benefits the whole community.

I am aware that research that promotes community participation can be "messy, complex and time consuming" (Adams & Faulkhead, 2012:107). A question that community participants in this study raised was about how they would benefit from it (Khupe & Keane, 2010). Contextual realities like poverty and unemployment made this an important concern. The long-term democratic and transformational goals did not necessarily meet their immediate material needs, and it was therefore necessary to negotiate other ways through which the community could benefit from the study.

While participatory inquiry is extensively used in the Health Sciences (e.g. Bergold & Thomas, 2012; Cargo & Mercer, 2008; Horowitz, Robinson & Seifer, 2009; Minkler, 2004), it has not been widely used in science education research in South Africa. The approach has been used for teacher professional development (e.g. Du Preez & Roux,

2008; De Lange, Olivier, & Wood, 2008) and for research into relevant science for rural communities (Keane, 2006a; Malcolm *et al*., 2009).

My use of TPR in this study was exploratory (Figure 5.1), in order to allow for flexibility in response the research context. This open-endedness strengthened the elements of participation as outlined by Hornung (2013, p. 141): through on-going consultation and negotiation for mutual understanding; respect for the land, people and culture; and through agreeing on outcomes and benefits. For me, these elements were a constant reminder of my research responsibility.

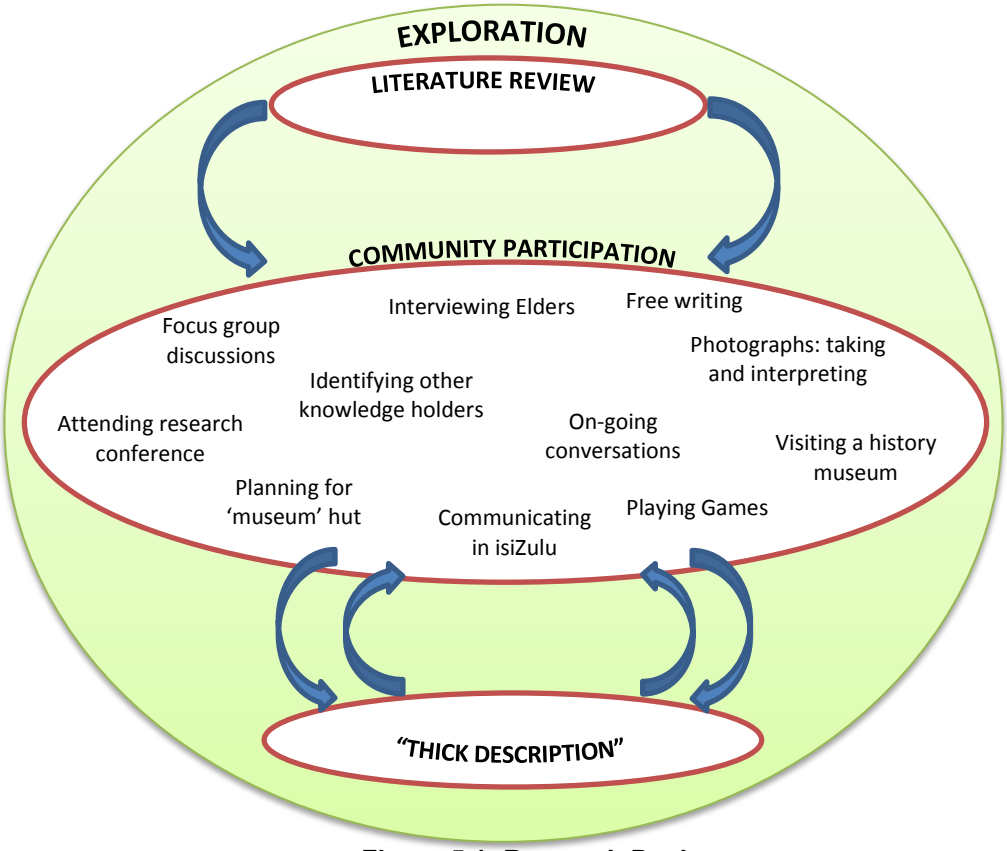


Figure 5.1: Research Design

The exploration proceeded at three levels. Firstly I embarked on a search and review of literature around my research questions. The literature served to illuminate both the subject of indigenous knowledge and the appropriate approaches to indigenous research. I started reviewing literature at the proposal stage and continued throughout the study, up to the time of reporting. I continually examined my field experiences in the light of the literature. The second level involved the collaborative engagement with the community. Our collective participation generated data in the form of spoken and written language. All activities were meant to highlight the experiences of community

participants from their own perspective. The third level of the exploration was in the reporting. I continued with the search for understanding through continuous collaboration when analysing and interpreting data. I explored ways of reporting that brought out participant voices. Although I have emerged as the narrator, the rest of the participating team's voices are 'heard' in the direct quotes used in the next two chapters. This process resulted in the "thick description" of procedures, results and discussion (Bogdan & Biklen, 2003; Ponterotto (2006).

5.3 Details of Community Participation

In line with the principles of participatory inquiry, participants in this study were not 'subjects'. I carried out the study 'with' them and not 'on' them (Reason, 1998). The participants were actively involved in the emergent processes of data gathering and interpreting the findings. In other words, the participants participated in the creation of knowledge (Malcolm *et al*., 2009). The different groups of participants enabled the understanding of different "versions of reality and to interrogate them to determine which version was most in accord with furthering social justice and human rights" (Mertens, Sullivan & Stace, 2013, p. 485). There were different layers (but not to imply any hierarchy) at which participants were involved in the study. For the study, the participants became a "community of interest" in local knowledge and education (Malcolm *et al*., 2009).

I present details of the community's involvement in the study with reference to Figure 5.1 above. I tried throughout not to make the participation just a token, but one where the community culture was acknowledged and where there was room for the participants to generate data (Pryor & Ampiah, 2004). In this section I explain the involvement of different participant groups. I present each group separately because they were involved in different activities (except when the students interviewed Elders). The data from the different activities were analysed and interpreted into one story (chapters 6 and 7) in a way similar to Pryor and Ampiah's (2004) data chains[26]. I start from the choice to communicate in isiZulu because it was used with both students and Elders throughout the study.

[26] Pryor and Ampiah (2004) used their different data sets not only as links in a chain, but also as prompts for reflection and for further discussion.

5.3.1 Communication in isiZulu

Language forms a repository of any culture's knowledge treasures (Vakalahi and Taiapa, 2013), and for the people of Mqatsheni, that language is isiZulu. IsiZulu is part of their identity. IsiZulu was the vehicle through which the students' writing created meaning and illuminated their social reality. Encouraging communication in participants' home language was not only respectful and appropriate in the context, but also created better rapport and led to more natural conversations (Pryor & Ampiah, 2004). Students had the choice to communicate (both orally and in writing) in either isiZulu or in English. Both their spoken and written Zulu was rich in metaphor which expressed meaning that was deeper than when they said the same thing in English. I include examples of students' expressions when I discuss language in Chapter 6. I learnt through this study the strength of Odora Hoppers' (2002) assertion that English connects us globally, but alienates us locally. Therefore, communicating in isiZulu strengthened epistemological access to the participatory process.

5.3.2 Student participants

The participating school is the only high school in Mqatsheni, in the centre of a remote rural community. The school is functional and is marked by high teacher presence and general order. The principal and teachers are welcoming. The school offers both Life Sciences and Physical Sciences at the Further Education and Training (FET) Phase[27]. I worked with two science classes of Grades 10-11 students (35 girls and 19 boys) (Figure 5.2 and Appendix 6 for list of student participants). Grade 10 is the beginning of the FET Phase where students' choices of subjects determine their possible career paths. There are two subject groups at the school: sciences and commercials. The science classes do Mathematics, and one of three sciences: Agricultural Sciences, Life Sciences and Physical Sciences.

I worked with 30 students in the Grade 10 science class beginning from August 2009. We agreed with the school authorities that the class would participate while in Grades 10 and 11. I could not fix dates for completion of fieldwork at the beginning as I was not certain how processes would unfold. At the beginning of 2011 when the class was in Grade 12, I requested to work with a new group, in line with our earlier agreement to not work with students in Grade 12. I was given permission to work with the 2011 Grade 10 science class. The new class had 24 students. The students were aged between 16 and

[27] In South Africa, high school education has two phases: the General Education and Training (GET) which covers Grades 8 and 9, and the FET Phase (Grades 10-12). At GET, students learn Natural Science. At the FET Phase, those students who choose to pursue the sciences do Life Sciences and/or Physical Sciences.

19 years. All 54 student participants were first-language isiZulu speakers. The student population could be considered culturally homogenous but not necessarily homogenous in any other ways.





Figure 5.2: Students working on writing tasks

The students were a very important group of participants, because they represented the youth – the new generation to which any knowledge that the community held would be passed. The students held a special position, having experience in both the Zulu way of life and modern schooling; hence they formed a link between the school and the community. In terms of the community's knowledge, I premised that any knowledge that the students expressed represented what had survived loss over the years, and could probably also be passed on to the next generation.

The choice of tasks for work with the students was influenced by their usual classroom activities as well as what could be empowering for students in their context. For instance, although free writing, excursions and the use of games are not common tasks in their science learning, I used them to shift the students' thinking away from the idea that I was looking for 'right answers'. Students would have found completing worksheets (and probably questionnaires too) more familiar.

At the beginning of the study, the students completed a semi-structured questionnaire (Appendix 9) to explore their thinking around the occurrence of rain, lightning and thunder. The choice of this activity was influenced by my own experiences as well as previous research interest in learners' ideas about lightning (see Maduna, Masuku & Gundry, 2008; Moodie & Ndlalane, 2008). In many parts of Southern Africa, although it is widely accepted that lightning and thunder are natural occurrences, wicked people are believed to have powers to make lightning and send it to targeted enemies, making it difficult to distinguish between the natural and the human-made lightning. Lightning and thunder are common occurrences in Mqatsheni, just as they are in much of tropical Africa. Students' responses would shed light on what form of knowledge (between home knowledge and school knowledge) influenced their ideas on rain and related phenomena more. The questionnaire was meant as a pointer to issues that would need further discussion and investigation (Pryor & Ampiah, 2004). The questionnaire responses were followed up with a whole-class discussion in which I followed up on matters that had been raised, particularly pertaining to local strategies for protecting people from lightning. The discussion was video recorded and later played back to the students. Watching themselves on a television screen and listening to their own voices, generated a lot of excitement.

For much of the time, the majority of students were quite shy and would not talk openly. I could not determine with any certainty why they were so hesitant to talk. Was it that our relationship was still too new to permit any meaningful discussion? Was it about age

difference? Or perhaps that they were just not used to the freedom to hold discussions? Whatever the reason was, I realised the need to broaden the range of activities for students beyond discussions. As a result I broadened the search for knowledge and worldview to include local games. In groups the students chose a game, explained how it was played and its moral significance and then presented it to the rest of the class. A second purpose of the games was also to relax the situation to encourage students to speak out. Although there was not much variety in the games presented, the second objective of using them was achieved. Some groups sang while presenting their games. For other groups, it was the audience who sang and danced. Singing brought life to the whole activity.

We (collectively with the class) continued with the 'warming up' activities in later visits, using both local games and those from outside of Mqatsheni. One such game from outside the community was 'snakes and ladders'. The students played the game in groups. I later asked them to write down their thoughts about how they related 'snakes' and 'ladders' to their own life situations. Respect stood out as a prominent issue from this exercise. I followed up on the matter with the students and the Elders (see Khupe, Keane & Cameron, 2012).

Writing later became a major activity for the students. It was the most extensively used of all forms of participation in this study. In using writing as a method, I was aware of its limited potential to generate data especially in an oral culture, but I had to take this alternative to ensure more meaningful involvement by the students, and the open discussions had failed to achieve this. I drew on the experience of my own social upbringing (where children had limited freedom of speech) to shift towards writing. Besides, writing down responses is something that students are used to doing, albeit not in the open-ended form. Writing had the potential for privacy of opinion, so it had the potential for richer data than an open discussion. The topics that the students wrote about were therefore carefully worded in English and then translated to isiZulu with the help of research assistants and teachers. The students generated a total of six sets of writing on the following topics:

- *Umuntu onolwazi endaweni yakithi* ngu… (A knowledgeable person in our area is…)
- *Chaza okubona esithombeni* (Describe what you see in the picture[28])

[28] This task was based on photographs take within the locality of Mqatsheni. The students could identify the items/features on the photographs with relative ease.

- *Izinto ezibalulekile engizifunde ngasekhaya* {The important things that I have learnt from home}
- *Uma kungafika izivakhashi endaweni yakhithi, ngizozibonisa… {*If visitors came to my area, I would show them…}
- *Ikusasa lami* {My future}
- *Izinto engifisa ukwazi ngokujulile* {Things that I wish I could understand better}

Other writing was based on respect (described in Khupe, Keane & Cameron, 2012), and on drawbacks and opportunities in their lives, based on playing the game of "Snakes and Ladders". I read each set of texts on the day I received them, and took note of any unfamiliar terms so that I could seek clarification with the authors[29]. I carried forward the issues raised by students to the Elders and the teachers, but being careful not to disclose the students' identities.

The students' writing reflected on their sociocultural context. As a method of creating data, writing opened up spaces for students to tell about the world as *they* perceived it (Chinn, 2007; Richardson & St Pierre, 2005) and they creatively used language in the process. As expressed by Richardson and St Pierre (2005:960), language became

> …a constitutive force, creating a particular view of the reality and of self. Producing 'things' always involves value – what to produce, what to name the productions, and what the relationship between the producers and the named things will be (Richardson and St Pierre (2005:960).

The 'force' that language is, as described by Richardson and St Pierre (2005), can only come about when one is communicating in one's home language. For that reason, it was the participants who decided what language they wanted to communicate in.

The importance of students' writing developed as the study progressed to enable the determining of the extent to which knowledge and values were shared between or passed on from Elders to the younger generation. In other words, the students' writing helped to establish what discourses on Indigenous knowledge were available to younger people in Mqatsheni (Richardson & St Pierre, 2005).

The students also interviewed some Elders. In Zulu culture, it is not children's place to ask older people questions. Requests were made beforehand through the research

[29] Students had the choice to either write their names on the scripts so that what they wrote could be attributed to them personally, or to not write their names so that their responses were part of pool. For the majority of the tasks, the students revealed their identity.

assistants who, throughout the study, played the role of 'cultural consultants', a construct that I borrow from Vakalahi & Taiapa (2013). The Elders agreed to the students going to their homes to learn about life in Mqatsheni when they (the Elders) were the students' age. The interviews were preceded by a discussion session that involved respectful ways of conducting interviews. There was mutual learning for all participants. The students shared cultural knowledge: greetings and introductions in a respectful manner. They (students) learnt conventional research knowledge: explaining the purpose of the project; the manner of asking questions; importance of taking notes and thanking the Elders after the interviews. There was class practice before going out into the field. The students went out in groups of five, each group going to a different Elder, but all groups were working with the same set of questions (Appendix 8).

It is more natural in traditional cultures for the older members to initiate discussion than for the young to do so. I foresaw a three-fold benefit of the interview task for the students. Firstly, it gave the Elders opportunity to directly contribute to the transmission of the knowledge that they have and value to the younger generation. Secondly, the exercise rightly placed the Elders in their position of knowledge authority, which might have been compromised through the spread of modern schooling – leading the children to thinking they "know" better than their Elders. Thirdly, the strategy led to sharing research skills with the students in harmony with participatory inquiry. Besides, collecting and processing data is an important component of some of their school subjects. The Elders interviewed by the students later also participated in focus group discussions, an activity that created an opportunity for comparison of responses presented by students and those that came out of the Elders' FGD.

Students participated in more ways than can be described in detail here. They worked on activities that were directly focused on their IK and worldview. They wrote songs and poems and they took photographs. Taking photographs as a data collection method in science education research was used by Keane (2006) and Mudaly (2010). The students wrote about photographs, and they completed worksheets. They visited a history museum in Himeville and completed worksheets about what they learnt during the visit. The students' responses in the different activities contributed to the voice of the youth, and to the total learning experience that was part of this study.

5.3.3 Elders

A total of 21 Elders (10 females and 11 males) participated in this study (Figures 5.3 and Appendix 7). Elders are the custodians of traditional knowledge. The Elders are the







Figure 5.3 University and community participants

link with the past, and the knowledge they hold is what was passed on to them by their own fore bearers. By virtue of their age, the Elders have the longest experience of Indigenous knowledge in Mqatsheni.

Two 'types' of Elders participated in this study. One group constituted 'Elders' by virtue of age, and the other by virtue of membership of the Traditional Council (TC). Fourteen participants were TC members and 7 were not. The composition and functions of Traditional Councils are outlined in the *Traditional Leadership and Governance Framework Amendment Act No. 41 of 2003* as well as the *Kwazulu-Natal Traditional Leadership and Governance Bill, 2013*. Two of these functions particularly relate to this study:

A traditional council must:

- manage the affairs of isiZwe[30] in accordance with the customary law and customs of the community concerned .
- promote indigenous knowledge systems for sustainable development and disaster management.

(*KwaZulu-Natal Traditional Leadership and Governance Bill, 2013*: Paragraphs 33.(1)(a) and 33.(1)(i)).

The extent to which members of the TC performed the functions above will unfold later in this report.

Members of the Traditional Council pointed out other community Elders who were not in the council but could share some of their knowledge and experiences. I requested to have interviews with such Elders and this was granted.

Elders who were members of the local traditional council met monthly to deliberate on matters that concerned the community. After initial meetings for introduction and explaining the study, they consented to having group discussions on local knowledge and education. The first focus group discussion (FGD) with Elders was a follow-up to data that had come up from individual Elders who had been interviewed by student participants (Appendix 8). It was a way of confirming data collected by the students. The FGD also provided opportunity for data that went beyond the individual to collective memory and a more collective community understanding of indigenous knowledge and education (Wertsch, 2002).

[30] IsiZulu for local communities.

The second FGD followed up on issues raised by students, for example, the importance of respect; the importance of grass-thatched huts in the Zulu culture; and the Elders' views on what forms of local knowledge could be taught in school. The third FGD came when general consensus had been reached about constructing a traditional Zulu hut on school premises[31]. The hut would hold a two-fold significance. Firstly it would be a symbol of the community's knowledge and would house traditional Zulu artefacts. Secondly, its siting on school grounds would symbolise the coming together of Zulu ways of knowing and modern science, in line with the major purpose of the study. The third FGD was for planning for collective action on how to use the data we had so far gathered. The hut would be a tangible benefit of the community's participation in the study. The three focus group discussions generated more than six hours of digital video footage.

Doing FGDs with Elders was in line with the traditional Zulu concept of '*indaba*'[32]. The discussions all took place at the traditional council premises. The discussions proceeded in a manner typical of council meetings: starting with song and prayer, and ending with sharing food. A strength of focus group discussions is that they have potential to produce "poly-vocal texts" (Kamberelis & Dimitriadis, 2005) and offer opportunities for the co-creation of knowledge with the community. I am aware of the limitations of using FGDs. In some cases, for instance, individual expression may be dominated by what the group expects everyone to say or believe. Since these discussions were video recorded, I made efforts during transcription and analysis to look out for non-verbal communication such as gestures and facial expressions that could have been used in the place of the spoken word. Sometimes too, one person can dominate the discussions thus limiting the capacity of the discussion to generate the opinions of many participants. In facilitating the discussion (a role that I had been accorded by the Council), I took care to encourage everyone to be involved.

In their collaboration the members of the traditional council played a crucial role in identifying and negotiating the consent of more members of the community who could share knowledge. This method of identifying participants was also used by Vakalahi and Taiapa (2013) in their study with Maori grandparents and grandchildren. Approaching

[31] It should be noted that the plan for the construction of the traditional hut had been approved by the Traditional Council, representatives of the Department of Education, and the School Governing Body, and funds were made available for it. However, the construction did not materialise due to local leadership tensions. I do not report on findings relating to this hut because they would compromise some participants.
[32] An *indaba* is a Zulu term referring to a meeting of leaders of a community (*iziNduna*) to discuss matters of concern to that community. In an *indaba*, participants have the freedom to say out what they think.

the Elders with reference from the traditional council validated the exploration. I carried out in-depth interviews with seven such Elders (a single lady and three married couples) all audio-recorded. I tried to make the interviews as conversational as possible, letting the participants give their narrative while I listened (Chase, 2005). The interviews helped in following up on issues raised during elders FGDs. They were also useful in getting individual elders' perspective on issues where 'group think' might have overridden individual voice. The interviews took place in the Elders' homes where the Elders were in charge. Interviews were unstructured and open-ended, allowing participants to explain more on issues being discussed (Pryor & Ampiah, 2004).

I gave on-going feedback on progress made, and also asked for the Elders' input on future plans. I called the Secretary of the Council in between visits, and the leader of the larger project also paid regular visits and assisted to keep communication with the teachers and the TC. The on-going communication contributed to the shared enthusiasm for the research purpose and enhanced community ownership.

5.3.4 Teachers

Two female teachers (one for Life Sciences Mrs BM, and the other for Physical Sciences, Mrs AN) and one male teacher (also the school principal, Mr PS) participated in the study. The Life Sciences teacher, Mrs BM is from a neighbouring village from which she commutes to school. Mrs AN's home is in Pietermaritzburg, more than 70km away from Mqatsheni. She stays in Mqatsheni and only goes home to her family some weekends and school holidays. Mr PS grew up in a village not far from Mqatsheni. He lives in Underberg, and so drives daily to and from school. He teaches Agricultural Science. Prior to joining the Department of Education Mr PS worked in the local area as an Agricultural Extension Officer.

The role of the teachers in terms of the study was that of 'guides'. They all have been working at the school for more than ten years and so they know the community well. Although they were hesitant at the beginning, the teachers' participation contributed immensely in creating ideas about the how integration of Indigenous knowledge and school science can be done in the context of Mqatsheni.

I liaised with the teachers on appropriate times to go to Mqatsheni and when to do activities with students. The Principal played a crucial link role in negotiating with the Education Circuit Manager and the School Governing Body regarding the plans to construct the traditional hut at the school. I kept the teachers updated on activities with

elders and students. We (the teachers and I) discussed plans and tasks, and they assisted in translating tasks from English to isiZulu. The teachers reminded students about tasks that they had to work on between my visits. The teachers' knowledge and experience of working in Mqatsheni was a basis for sound advice on feasibility of plans. I interviewed Mr PS and Mrs AN.

By way of benefit to the school community, the broader project provided funding for one of the teachers to attend the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) conference in 2010. The school decided that Mrs AN would attend. After my presentation at the conference (Khupe and Keane, 2010), Mrs AN spoke to the audience about her experience and her view of the participatory process.

5.3.5 Research assistants

Two young men who were former students at the school, and also working at Khuphuka, agreed to participate as research assistants. I worked with Skhumbuzo first, when he was Khuphuka's Youth Coordinator. In 2010 he became the manager of Khuphuka's operations, and so did not have much time to continue directly participating in the study. He recommended Vincent to take over the role he had been playing in the study. Vincent accepted the extra responsibility. Skhumbuzo and Vincent both took photographs and did the video recordings, assisted with advice, communication with Elders, and with setting up logistics.

Skhumbuzo and Vincent played the role that Vakalahi and Taiapa (2013) refer to as cultural consultants. They advised on cultural protocols - who to see and how to relate with them. They liaised with the Traditional Council leaders on when to hold meetings. They assisted with explaining unfamiliar Zulu terms especially those emanating from discussions with Elders. Skhumbuzo and Vincent learnt to use the camera and they recorded FGDs. They took me to Elders' homes for interviews. The many conversations I held with Skhumbuzo and Vincent immensely contributed to my understanding of the context of Mqatsheni.

5.3.6 Additional community participants

The choice of these additional participants was informed by their long experience of working in the community and was the result of snowball sampling, in which school and community participants pointed to others who were known for working in the locality. I include three such people below.

Uncle Mike

He is affectionately addressed in the community as 'Uncle Mike", and I also refer to him in the same way in this report. He was of mixed race, and probably in his fifties. He grew up on a farm about 10 kilometres east of Mqatsheni. Uncle Mike's family farm is adjacent to a Zulu village, and so he grew up to develop strong Zulu and English identities. During one of my week-long field visits, Uncle Mike was doing construction work at Khuphuka. He gave me lifts from Underberg to Mqatsheni and back that whole week. Conversations with him revealed his strong attachment to Zulu traditional knowledge and practices, especially in farming. I then requested a formal interview with him and he consented. Uncle Mike has a house on the farm, built in traditional Zulu style. He also owns residential property in Underberg. I view Mike's contribution as vital in providing both insider and outsider perspectives, and thus acting for me as a 'culture broker' (Aikenhead, 1996).

Sister Abegail

Sister Abegail Ntleko was a retired nurse and was 75 when I first met her. She is the founder of Clouds of Hope (a home for orphaned and vulnerable children in Underberg), and chairperson of Khuphuka. Sister Abegail was an award winner of the 'Unsung Heroes of Compassion Award' from the Dalai Lama (Ntleko, 2012). She ran a mobile clinic service in Mqatsheni for three decades; hence she is very familiar with life in that community. In addition, she is Zulu-speaking. Sister Abegail's life and work is a typical representation of *ubuntu* – where self is defined by one's contribution for the greater good of the community.

5.3.7 An outsider's perspective

Jacq

Jacq is an Irish woman and co-founder of Khuphuka. Working in Mqatsheni was her first experience of being in a South African rural context. Her views provide an outsider's perspective. Her impression about the way of life in Mqatsheni provided insights into both knowledge and worldview that I (as one who grew up in a rural African community) would have been too familiar with to be able to identify.

The methodology that emerged for the study, based on the framework described in Chapter 4, meant that it was possible for me to be flexible and tentative in the day-to-day planning and execution of the study. This made it possible to follow up, refine and develop ideas in response to the context. The participants' day-to-day activities influenced decisions about ways of gathering and interpreting data. For instance, Elders

who form the Traditional Council met monthly to discuss issues of community concern. Together with the Elders we carried out Focus Group Discussions (FGDs) along similar lines to the Traditional Council meetings. This way, the Elders were operating in their usual space of authority and would be more likely to feel properly positioned to participate in the group discussions. Interviews took place in Elders' own homes, where they were in positions of authority in terms of social structures and in terms of knowledge.

5.3.8 My participation

Considering my own writing as an instrument is an idea I got from St Pierre (2005). My writing (field notes and reflections) proceeded alongside other forms of data collection and was intertwined with initial stages of analysis (sorting, coding and identifying themes). I recorded my thoughts at different times during the study. I wrote a lot when I was in the field. I also recorded thoughts prompted by formal and informal conversations with the project leader, with the co-supervisor and with colleagues.

During the fieldwork, I learnt the value of keeping plans open and flexible. My plans were at the mercy of the elements: the storms and rain and snow. Roads were sometimes impassable, and a whole week of planned activities would be lost. I learnt to care more about participant wellbeing than making progress in collecting data. During the study, participants lost their loved ones, and worse still, a participant died[33]. I could not proceed with 'business and usual', but needed to adjust plans and acknowledge the loss in a respectful way.

5.4 Ethics

Participatory research centres on people in relationship with each other and with the research topic (James & van Laren, 2009; Malcolm *et al*., 2009). It is about personal relationships that have to be established and maintained within given socio-political contexts. Access to a community is not a matter of right (Cohen, Manion & Morrison, 2000; James & van Laren, 2009). Negotiating access is a methodological and ethical issue, and is a requirement of all acceptable academic research. University ethics clearance procedures are only the beginning of a journey that lasts the period of the study and continues into the reporting process. Like Keane (2008b; 2006a), I found

[33] One of the members of the traditional council, and a prominent contributor during FGDs, Mr Z.F. Myende died in March 2012. Mr A Zitha lost a sister and a daughter-in-law in 2010. The death of young parents often leaves the elderly taking care of grandchildren, and in some cases, even great-grandchildren.

myself continuously making ethics decisions, long after ethics clearance was granted. The fieldwork process naturally expanded ethical boundaries.

5.4.1 Negotiating access

When I first went into the field, I had all that my University required of me: participant information sheets; consent forms for adult participants; assent forms for minors, and the permission to carry out the research from the Provincial Education Department in KwaZulu-Natal. These documents met the legal requirements of the research as spelt out by the University, but not necessarily the flip side – the relationships side of the people with whom I was to work. To begin work in the community, I needed to negotiate my way through building relationships and observing community protocols (Hornung, 2013). My being a Black African woman (although I am from Zimbabwe), served as a point of connection with the Mqatsheni community (Vakalahi & Taiapa, 2013), as did my knowledge of isiZulu as well as my experience of living and working in rural areas. In addition, on-going consultations with research assistants contributed to developing the cultural guidance that I needed to understand the special values of Mqatsheni's cultural space (Hornung, 2013).

None of my visits to Mqatsheni was without the agreement of the community. I did not want to be seen to be intruding (Morgan, 1987). I called the principal, the teachers, and the secretary of the Traditional Council ahead of each visit. Carefully negotiating one's way into the participating community is a sign of respect for the participants' traditional and social structures (Hornung, 2013). Rural and Indigenous communities are structured differently from non-rural ones. There are certain hierarchies that exist in rural communities that do not exist in urban and other non-rural areas. Rural community structures are complex as they are usually governed through intricate networks of traditional, political and civil service structures. I will explain what I mean.

My research 'destination' was a village and school in the Southern Drakensberg, about 30km north of Underberg. I could not go directly to the school. The school is located within the community, and the community affairs are the jurisdiction of the traditional leadership. Informing the elders of my research intentions and seeking their permission was a necessary step of respect without which the whole future of my engagement with the community could otherwise be inappropriate. Making myself and my research agenda acceptable to the traditional leaders increased my chances of being accepted by the school, otherwise I would be at odds with my research approach and paradigm.

Recognising the position of traditional leadership enhanced the fostering of mutual trust with the rest of the community. In a participative project, trust in relationships is essential to the quality and outcomes of the research (Minkler, 2004). I was privileged to be granted access to different groups of participants, particularly the elders, a group to which one would normally qualify by age, residence status and wisdom (as defined by the community).

Although the different dimensions of access were challenging, they presented opportunities for my own learning, and hence my opportunity to contribute to understandings of research ethics in the context of rural South Africa.

5.4.2 Beyond written contracts

As mentioned earlier, my engagement with teachers and students had the approval of the Provincial Department of Education. However, this letter of permission did not mean the staff and students were under obligation to give me audience. Developing trust was important. Personnel at Khuphuka played an important linking role for my entry into and continued work in the school and community. Khuphuka was already an accepted part of the community. Skhumbuzo's agreement to be a research assistant positively contributed to relationship building. Skhumbuzo's reputation as a disciplined and successful former student of the participating school, had earned him respect from staff and students. This study benefited from some relationships that were built even before its conceptions.

Achieving access to the individual participants meant more than getting them to sign consent forms. It meant the person was allowing me to be part of their 'space'. The principal agreed that I work with staff and students. I still had to talk to the teachers, explain the purposes of the study and their part in it. They agreed to participate. I still needed to build a strong relationship with them to allay any fears of 'invasion of their territory' and placing undue influence on their students. We (I and the teachers) agreed from the beginning, that the study would not involve observing them teach, but would involve on-going conversations that would create a common understanding on the integration of IK and school science. It was with the teachers' consent that I got to meet the students.

Because of the largely oral nature of Zulu culture, as well as the importance of developing relationships, it would have been hasty to introduce written consent forms on the first day of meeting the different participating groups. During the introductory

discussions, I realised that the reality of the fieldwork was not just about getting a form signed, but more of trying to prepare the ground for meaningful, sustainable relationships. It was only on the second day that I gave the participants the forms, explained the requirement for the written contracts, and asked them to think about the contracts and sign up if they were comfortable. I only collected the forms during my second visit. Eighteen of the student participants had signed up for participation in the project, but 25 showed up. The other 7 'sat in' probably to ascertain the project was not 'harmful' before they could commit themselves. As late as my fourth visit, some students were still coming to ask for consent forms until the number grew to 30.

The Elders also signed consent forms. However, during the FGDs with the Elders, the secretary of the TC always double-checked with the members if they still approved that I recorded the discussions and took pictures. On all occasions the Elders agreed. This process made me understand the value of verbal agreements for the Elders, when I had thought the written agreements were adequate for us all. I learnt the importance of Mosimege and Holtman's (2012) emphasis on the use of appropriate ways of interacting with knowledge holders. The Elders had their own protocols which were through verbal consent and were presented in terms that they had created, and that they understood. I learnt too that the absence of written agreements does not mean that local communities did not have guidelines on how they expected researchers to interact with them and handle the co-created knowledge.

5.5 Learning through constraints

Throughout this study, I was mindful of my position as an outsider in Mqatsheni, but also careful not to let that be a major hindrance. I was conscious of my lack of eloquence in isiZulu, and so I sought help with the translation of tasks and other data collection instruments. Both my limited knowledge of isiZulu and my status as a foreign national strengthened the need to consult on the right steps to take and the appropriate things to say. Had I been more knowledgeable, I probably would have been less respectful. Being an outsider also 'freed' me from alignment with sub-groups that existed within the community. As an outsider I could take up leadership of the research project, but always working within the accepted cultural protocols.

The time of my first entry into Mqatsheni was a few months after wide-spread attacks on foreign nationals (in South Africa's major cities), which left more than 50 immigrants dead, scores injured and thousands homeless. I had anticipated that building

relationships would be difficult under these circumstances. On the contrary, I was warmly received by the Elders and the teachers. My experience was the opposite of what fellow immigrants were facing in the townships and informal settlements of South Africa's major cities. The warm reception that I experienced was illustrative of *ubuntu,* an ideal that seems to be continually eroded by modernisation and urbanisation. Therefore as fate would have it, the contrast between the xenophobic violence that swept across South African cities in 2008 and the warm welcome I experienced in Mqatsheni in 2009, actually alerted me in a practical way, to the dangers of being quick to make generalisations.

From the beginning, I did not foresee an objective, value-free research process. I recognised that I carried into the study assumptions relating to my own upbringing and experiences of living in a rural community[34]. These experiences and assumptions played a significant role in how I related with participants, collected and analysed data, and how I interpreted the results. As Khupe, Keane & Muza (2013) argue, my life experiences shaped the research processes.

I was guided by the nature of my research questions to using an interpretive inquiry. I believe that phenomena are understood in terms of the meanings people give to them (Marton, 1994; 1988). As a result, I used a wide range of data collection strategies, hoping to make each strategy contribute to an understanding of the knowledge and worldview in Mqatsheni. In as much as I envisaged that the community would share some knowledge, I also presumed that there would be forms of knowledge that they may hold as secret – knowledge that anthropologist, Jonny Steinberg (2008, p. 307) describes as the community's "collective sphere of privacy". Knowledge such as details of initiations is not normally shared outside the 'community of practice'. As an outsider, and especially as an outsider of the country, never mind the local cultural group, being allowed access to any knowledge was a great privilege. I owed it to the community to be respectful in both the way I related with them and in the way I handled the information that they entrusted to me. I had the responsibility to be faithful to collaboration and participate in the protection of local knowledge. At the end of the study, I summarised the research findings into a community booklet available in both isiZulu and English as a way to share the knowledge found.

[34] I fully explain my position relating to the research in section 1.5 of Chapter 1.

5.6 Working with the Data

The forms of data generated from this study include:

- video footage of focus group discussions with Elders;
- audio records of interviews;
- students' writing;
- photographs;
- completed worksheets; and
- field notes. I wrote notes from my own observations, and from both formal and informal conversations. The informal conversations were not so much for building up to the findings, but they immensely contributed to my understanding of the context.

I started analysing the data I was collecting just after I started fieldwork; hence analysis proceeded alongside data collection. This preliminary analysis helped me to identify issues that needed follow-up and /or member-checking and unfamiliar Zulu terms that needed explaining.

5.6.1 Interview and FGD data: transcription

I repeatedly listened to audio records and watched the video footage in order to familiarise myself with the data. I transcribed all the videos and audios myself; hence, as in Bird's (2005) description, I was researcher-transcriber. I understood that in transcribing, I was re-presenting the events (the interviews and FGDs), and that I would not be able to recreate the actual events (Tilley, 2003). Doing the transcription demanded a lot of time. I had more than 6 hours of video footage and almost 3 hours of interviews to convert to text. At the beginning, I needed an hour to transcribe no more than 5 minutes of talk. However, doing the task myself kept me immersed in the context of the events. I thus began analysing the data during the transcription process (Lapadat & Lindsay, 1999). During the process of transcription, I experienced Lapadat and Lindsay's (1999) observation about the importance of the process of transcribing, and particularly so when it is the researcher doing the transcription:

> …it is not just the transcription product – those verbatim words written down - that is important; it is also the process that is valuable. Analysis takes place and understandings are derived through the process of constructing a transcript by listening and re-listening, viewing and re-viewing (Lapadat & Lindsay, 1999, p. 82).

Therefore as observed by Bird (2005), in my case transcribing became a key part of data analysis. At the beginning of the transcription process I was just concerned about

getting the words right, but I soon realised that I needed to listen to tone, watch out for facial expressions and any other forms of non-verbal communication in order to get a clearer picture of the event being transcribed. I even needed to note how other participants' reacted to the one speaking. Because I had also been part of the interviews and FGDs, I could draw on memory and, to an extent, could re-live the experience, and understand meanings of words more.

5.6.2 Data in isiZulu: translation

Except for the data from interviews with Sister Abegail, Uncle Mike and Jacq that were in English, data from all other interviews and FGDs were in isiZulu. I chose not to translate the texts after transcription. I understood that translation was more than a technical process that any bilingual person could effectively do. Wong and Poon (2010) put it clearly:

> …translation is not a neutral technique of replacing words of one language with words of another language. It involves assigning meanings to words in both languages and is mediated by power relations and social contexts (Wong & Poon, 2010, p. 152)

Wong and Poon (2010) warn that the omission or addition of a word or phrase in a translated text can have a significant influence on data interpretation and meaning construction, and thus on the final representations of the participants. Meaning can be lost in translation, and that would be against the ethical principles of indigenous methodologies, particularly 'respectful representation'. For these reasons I chose not to do any wholesale translation of the texts. I analysed each data set in the language in which the participant either spoke or wrote. I constructed meaning from the data in the language of the speaker or writer. In this report, I have presented quotes from participants in the language of the participants. I translated the quotes for their meaning in the context of the original conversation or the writing, and enclosed the meaning translation in brackets {}. Quoting the data in isiZulu helped me to more accurately represent the participants. Translating the quotes for their meaning in this report gives me room to convey the participants' words to non-Zulu readers.

5.6.3 Multiple-stage analysis

After I had transcribed audio and video data and collated questionnaire, worksheet or other written data, I now had all data in the form of text. I then read and re-read the texts to get an initial sense of issues raised in the data (de Wet & Erasmus, 2005). I used footnotes to capture my reflections as I read the texts. For instance, I picked up the prominence of the issue of respect and traditional huts from this close reading stage. I

indicated in these summaries what research question(s) each set addressed, what aspects of the responses were common, and what 'gaps' there were that needed either follow-up or just for noting. This process helped me to have a good knowledge of the data, and also to identify questions that had not been sufficiently answered and needed follow-up. However, I found that I could not cross-reference data sets with ease because I had managed each data set as a separate entity. I needed a method that would allow me to see the 'big picture'.

Consequently in addition to the data summaries, I began to develop coding schemes based the research questions, after de Wet & Erasmus (2005) and later, Eisenhart & Jurow (2013). Besides bringing together selected data from all sets and making it easier for me to identify emerging themes (Miles & Huberman, 1994), this method was useful in identifying similarities and differences in the thinking of participant groups, as well as identifying occurrences of 'unusual' data. After this coding I was able to generate findings by carefully weighing evidence through checking their recurrence (or absence) across participant groups. I then started thinking of possible explanations (interpretations) for these findings.

Pryor and Ampiah (2004, p. 169) use the metaphor of data chains to describe their approach from "field experience to the textual outcomes of the research". They used video data produced by children as stimulus for reflection and discussion, which led to the generation of further data. I worked in a similar way, but I view the overall picture not as a chain, and not as linear as they illustrate it. I see the process (from the field to the research report) as more iterative and involving multiple processes of identifying themes at different levels. Firstly, I identified themes emerging from individual data sets (as in the example in Appendix 10). Secondly, I identified themes emerging from across data sets and across different participant groups. I put the themes from individual data sets to different participant groups for deliberation. This process enabled the production of multiple 'voices', expressed as "poly-vocal texts" in Kamberelis & Dimitriadis, 2005), which also gave room for collective interpretation and respectful representation (Louis, 2007). At these different stages, I continually referred to the literature but also kept the Mqatsheni context in mind.

Unlike in Pryor and Ampiah's study, I did not have a single starting point which acted as a stimulus for the development of data chains. Different participant groups were engaged in different activities during the same time period, allowing for the emergence of common themes across data sets. The issue of respect is an example of one of the

first emerging themes. Respect was mentioned when students wrote about their future; when they wrote about what counts as drawbacks and opportunities based on playing a game of "Snakes and Ladders"; and when they wrote about the important things that they learnt from home (see Khupe, Keane & Cameron, 2012). The Elders repeatedly pointed out respect as important but also as getting lost. The issue of respect thus emerged from multiple sources. Other examples of emerging themes that went through this multiple-stage analysis include: importance of traditional Zulu huts and importance of the mountains.

After identifying respect as an important issue for the community, I then took it to other individual participants for deliberation with teachers, Sister Abegail and Jacq (both of whom I call inside-outsiders[35]), as well as with Elders. Deliberating with inside-outsiders helped to bring together the views of those completely within the cultural setting with those who understood it from the outside, in keeping with cross-cultural research (Pryor & Ampiah, 2004). I also took the matter to the Traditional Council for a focus group discussion. Some of the Elders who had raised the issue of respect in the interviews were also going to participate in the FGD. The FGD provided a forum for the expression of collective voice, and generated further data and contextually appropriate interpretation.

After getting the perspectives of cultural insiders and inside-outsiders, I went back to the students to pursue the matter further. I called this stage, "probing". I wanted to better understand the students' perceptions of respect. I asked them the following questions:

1. *How do you respect?*
2. *Who do you respect and why?* (See Khupe, Keane & Cameron, 2012).

The students wrote down responses to these questions. Their writings generated more in-depth data on the issue of respect, and the data reflected a young people's perspective. Where it was appropriate, I did theory-based analysis of the data. For instance I used phenomenography to analyse the data on students' conceptions of respect (see Khupe, Keane & Cameron, 2012).

Multiple-stage data analysis resulted in a number of benefits for this study. Firstly, it allowed opportunity for participant involvement of in interpreting the data. The close involvement of participants resulted in a better understanding of the participants'

[35] I use the term 'inside-outsiders' to refer to participants who do not reside in Mqatsheni, but have experience working in Mqatsheni. Such people are therefore outsiders, but in some instances have an insider's perspective.

perspective. Secondly, the process increased methodological rigour and authenticity of findings. Thirdly, the integration of emerging and theory-based analysis suited the integrative research framework discussed in chapter 4, and put the findings in Mqatsheni in a global context.

5.7 Summary

In this chapter I described the methods that shaped this study. I described my entry into Mqatsheni as a cultural outsider and foreign national, and how I developed participatory partnerships with the community. I described how I negotiated entry in culturally respectful and ethical ways, which in many ways, extended beyond University ethics requirements. I also described how I worked with different sets of data towards developing findings, and how the participants were involved in multiple-stage data analysis. In the next chapter, I will present and discuss findings from this study.

PART THREE

CHAPTER 6: FINDINGS 1: KNOWLEDGE AND WORLDVIEW

CHAPTER 7: FINDINGS 2: SPACES FOR IK-SCIENCE CURRICULUM INTEGRATION

CHAPTER 8: CONCLUSION

CHAPTER SIX

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CHAPTER SIX

FINDINGS 1: KNOWLEDGE AND WORLDVIEW

6.1 Introduction

What forms of IK does the community of Mqatsheni hold, and what do these knowledges and practices reveal about worldview? Which aspects of the knowledge could be included in school science and how might this be done? These three questions were at the core of my research study. Answers to these questions constitute the major findings and are critical in making recommendations about the integration of IK and science in communities similar to Mqatsheni. In this chapter, I focus on the first two research questions. I present and discuss findings on Indigenous knowledge and worldview that emerged from interacting with the people of Mqatsheni.

As explained in Chapter 5, I collected much of the data for this study in isiZulu, the first language of the community participants. The Elders communicated in isiZulu in interviews and group discussions. The student participants had the choice of responding in either isiZulu or in English. To avoid misrepresenting the participants, I have presented the data in the language used by the participants (either isiZulu or English). IsiZulu quotes are in italics, followed by an English translation of the participant's words, *for* meaning. I took utmost care to ensure accurate translation, by not simply extrapolating the meaning of the participant's words, but also considering the context of the whole discussion. In addition, I had the translations checked by a colleague, for whom isiZulu is a home language. However, I cannot rule out the possibility of loss of original meaning, in which case the isiZulu version remains as the better representation of the participants' views. In cases where I quoted responses made in English, I did not

use italics. In cases of quotes in English, I also did not correct the participants' grammar.

In this thesis, I refer to participants by name, and this is with their consent. They chose not to be anonymous, and in any case, treating them as anonymous would not be ethically appropriate, because in the context of this study, they are knowledge co-creators. I also use English titles (Ms/Mrs/Mr) in referring to adult participants, and I refer to the younger participants by their first names. During the study, I referred to the Elders as *"Mama"* (Mother) and *"Baba"* (Father) as is appropriate in addressing older people in Zulu custom. Elderly people are not called by their first names in isiZulu.

6.2 Knowledge in Mqatsheni

The forms of knowledge that emerged from this study are:

- knowledge of place;
- practical skills;
- cultural practices; and
- language.

The knowledge forms were closely connected and they sometimes overlapped. I only present them separately here for easier interpretation and discussion, but not to make them discrete. The knowledge revealed a worldview that gives prominence to relationships and interconnections of the social, physical and spiritual worlds. I present these findings mostly in the form of direct quotes from the participants. I selected these quotes on the basis of their richness and representativeness of community views (as in Messias, Jennings, Fore, McLoughlin & Parra-Medina, 2008).

6.2.1 Knowledge of place

Both the young and adult population of Mqatsheni know the geography and history of their place well. This knowledge includes awareness of natural[36] and man-made resources; the socio-political histories; the historical changes to land claims and the resultant challenges. Although the cumulative effects of changes in land tenure over more than two centuries contributed to upsetting the cultural order in Mqatsheni, the people still have a sense of claim to the land and its resources. The people are proud of the mountains, the beautiful rocks, rock paintings and the springs which ensure water supply for locals, and the people in lower-lying areas. The knowledge about place is not

[36] In isiZulu, knowledge of Nature is called *ulwazi lwemvelo*.

simply presented as an inventory, but suggests the existence of deep-seated relationships with the natural and the spiritual world:

> *Indawo yethu iyindawo enawo amagugu esizigqaja ngawo noma esingaziqhenya ngawo ukuthi sinawo, nesifisa ukuthi athuthukiswe sifinyelele ukuthi avele. Njengokuthinje thina siphuza i*spring water*. Kune siphethu lapho okugobhoza khona umfula omkhulu uMqatsheni uze uyengenela kuMkhomazi* (Ms Majozi, 12 May 2010).
> {Our place has features that are precious to us and that make us proud. We want these features to be developed so that they are better known. We drink spring water. There is a spring here from which the big river uMqatsheni flows till it joins Mkhomazi River}.

> *Indawo zonke ezingezansi ziphuza thina. Imithombo yonke yamanzi, iziphethu ziphumala. Imifula iphuma phansi, beseyinikeza indawo zonke ukuba ziphile. (Elder Zitha, 12 May 2010).*
> {All the lower-lying areas drink [from] us. All the wells – the springs originate from this place. The rivers flow from here and give all the other places so they can survive}.

The people and natural features in the area (in this case the springs) belong together and Mr Zitha binds them together in his use of the pronoun *thina* (meaning "us"), hence the lower lying areas "drink [from] us". The river is presented almost as living, and as able to make conscious decisions to supply the different places with water. The people's expressed closeness to Nature fits with the anthropomorphism of African traditional culture and religion. Similar anthropomorphism is shown in descriptions of Khanti, the closest of the UKhahlamba Mountains (Figure 6.1). The mountain is described as important, beautiful, wealthy, peaceful, forgiving, as having a history and as loved by the locals:

> *Lentaba le uyibona, siyazi* in and out*. Le ntaba le uyibonanje...konke okuphathelene nomnotho kubuzwa laphaya kuyo intaba enhle yangakithi. Kuphelanje ukuthi ayinakiwe* (Siphesihle, PA 2011).
> {We know this mountain in and out. Our mountain can be consulted on matters related to wealth. The only problem is that it is not properly looked after}.

Siphesihle's use of the plural "we" shows she is describing knowledge that is common to the whole community. Her description of Khanti Mountain implies that the mountain is sacred. The lack of proper care might probably refer to failure to follow appropriate cultural protocols when up the mountain, such as not speaking when in certain parts of the mountains. The mountain represents a deep relationship between the people and their natural and even spiritual environment. The relationship might probably have been at its best during the times when the people were still free to graze their livestock in the

mountains, and when the mountains were still used as venues for initiation and other cultural ceremonies. Movement in the mountains is now restricted and the people now have to be issues with permits in order for them to go up the mountains, or they risk being arrested for trespassing.



Figure 6.1: Khanti Mountain

For the community, Khanti is much more than the Earth Sciences view of it as a mass of volcanic rock that has withstood millions of years of erosion. The mountain is seen as closely connected to social economic and spiritual well-being of the people of Mqatsheni. The Western perspective, on which school science is based, does not accept anthropomorphism within its knowledge boundaries (see for instance, Horsthemke, 2004). However, anthropomorphism embodies qualities of respectful relationships with Nature (as shown in Mqatsheni), and can contribute to sustainable development and environmental conservation (Kawagley, Norris-Tull & Norris-Tull, 1998), in much the same way as Earth Summits.

The people and their place are connected in a way that transcends geographical location:

> *Inkaba yami ila kaMaguzwana*[37]*. Ngikhulele la kaMaguzwana (Mr Cekwane, FGD October 2010).*
>
> {My umbilical cord is here in Maguzwana. I grew up here in Maguzwana}.

[37] Another name for Mqatsheni derived from the name of a former chief.

[Itshe] lakhiwa nguNkulunkulu iminyaka ngeminyaka. NguNkulunkulu indawo ayenza. Ziningi izinto ezila uNkulunkulu asenzela zona (Mr Zitha 12 May 2012.
{[The rock} was made by God many years back. It is God who made this place. There are many things that God made for us}.

Siyayithanda indawo yakithi okokugcina. Ipholile, ayinawo umsindo. Ayinalo udlame. Iyindawo enokuthula. Yawela yilizwi likaNkulunkulu. Lawela kulezintaba zalendawo (Ms Majozi).
We love our place very much. It is peaceful. It has no violence[38]. It is a peaceful place. The word of God fell onto this place. It (God's word) fell onto the mountains in this place}.

The Elders here are not just expressing some sentimental connection to the place of Mqatsheni. Part of the people, the umbilical cord[39], is buried in this place hence they have an 'undying' connection with the place. They do not view the umbilical cord as "dead and buried", but as continually living, connecting the people to the land, and the living with the dead. The appreciation for the importance of the land therefore naturally flows from this connection. Expressing the symbolic connection of people to place using the umbilical cord is also used by the Cree people of Canada: "To connect and displace Woodlands Cree people from the land is to sever the umbilical cord and life blood that nurtures an ancient way of life" (Michell, 2005, p. 38). The umbilical cord is thus an expression of a life bond between indigenous peoples and their lands.

The people's knowledge of place is also expressed through practical skills. For example, the design of traditional dwellings is suited to the cold and windy conditions that Mqatsheni so often experiences. The grass roof is reinforced in such a way that it cannot be easily blown away (Figure 6.2). The walls are a conglomeration of wood, mud, stone and grass (Figure 6.3) for insulation from the cold. Every home has at least one such hut. Besides the fact that these traditional-style huts offer good protection against prevailing weather conditions, they are also the convenient meeting place for the people and the spirits of their ancestors. I will revisit the matter of traditional huts later in this chapter.

[38] The violence that Ms Majozi was specifically referring to here may be political violence, which rocked many parts of KwaZulu-Natal in the 1990s. Later on in the same discussion she and the other Elders bemoan the prevalent cases of rape and other forms of sexual abuse against children, women and old people.
[39] It is Zulu custom to bury the umbilical cord after a baby's birth. This practice symbolically attaches each person to the land.



Figure 6.2: A hut under construction: walls yet to be built



Figure 6.3: A hut with corrugated iron roof, walls made of mud, stones and grass – outside wall yet to be completed.

Participants have a deep sense of awareness of the changes (many of which they view

quite negatively) affecting this place. They lament loss of their land through decades of 'foreign' forms of governance[40]; changes in land use policies which created boundaries that locals are not allowed to cross; and the continued expansion of commercial forestry and of invasive plants. As a result, crop farming is dying away and livestock rearing is under threat. Movement into the mountains is restricted. The cumulative effects of these issues are felt in both the amount of land available to the people of Mqatsheni, as well as in their cultural practices. The Elders bemoan the loss of underground water; arable and grazing land; thatch grass (an important material in construction of huts); and the loss of beauty of the land itself as a result of invasive plants:

> *Indawo yakithi isincane kakhulu. Sihleli kabuhlungu ngenxa yamahlathi. Ayinciphisile indawo impela kakhulu. Ayivalile indawo. Awadlile namanzi* (Mr Zitha, 12 May 2010).
> {Our place is now very small. We are settled in uncomfortably small spaces because of the plantations. They (plantations) have greatly reduced our place. They have closed up the place. They have used up [underground] water}.

The restricted movement imposed on the residents of Mqatsheni by UKhahlamba Drakensberg Parks Board has negative effects on the people's Zulu cultural identity.

> *Sivinjiwe ukuthi singabi sisaya entabeni. Kanti entabeni thina sikhula singabafana, besihamba khona, sihamba nezinja sizingela sisenzani, sigawula induku - senza yonke imikhuba yabafana. Bonke abantu babehamba entabeni...kodwa ngokunqamula kokuthi kufakwe leli* curtain*...* (Mr Majozi, 26 October, 2010).
> {We are restricted from going to the mountains. In these same mountains, when we were still young, we would go with our dogs. We made fighting sticks and hunted and carried out all other rites as was customary for boys. All the people used to go to the mountains. But now with the boundary created by this curtain…}.

Restrictions on movement into the mountains have disrupted not only the knowledge of place, but also the cultural practices and practical skills that are associated with Zulu traditional life. For centuries, the mountains were the centre for teaching and learning in traditional Zulu life (e.g. hunting, herding cattle, playing games and initiation into manhood and womanhood). The mountains have been part of the people's connection to place. Now, the mountains have been screened off and cast behind a 'curtain' with little consideration of the extent of the effects on the socio-cultural lives of the people to whose livelihood the mountains had been closely connected for many generations. The people's ties to the land and the mountains have been severed and thus, in a way, so

[40] This 'foreignness' relates to both the apartheid and current post-apartheid eras. The Elders view the socio-cultural values of the democratic government as 'foreign', especially relating to teaching and disciplining children.

have their spiritual connections.

Apart from the challenges related to the land, Mqatsheni suffers from scourges of unemployment, poverty and disease. Even the students are conscious of these issues, but not in a sense that depicts helplessness. The consciousness seems to spur them into thinking with a sense of agency. Throughout the study, the students show that they want to help the suffering: to care for the sick and the orphaned; to contribute in fighting child abuse and to help their families. In short, the students look forward to giving back to the community through active service. For these students, the future is not just for themselves as individuals. The future is an opportunity to serve their community in their areas of need. Such service is not just about providing for the orphans physical needs (e.g. food). It is about meeting their emotional and security needs too:

> I like to be a social worker. Firstly in our country there is a high rates of poverty and there are many orphans, many average people who wants to be protected and loved…when I saw orphans who are not protected my heart was broken down (Victor, 2011).

But there is a challenge to these values, coming through crime. It is generally accepted that out-of-school unemployed youth are the perpetrators of crime in Mqatsheni. The criminal activities probably arise as a result of frustration from unemployment and lack of better things to do. The younger, in-school youth value life and the principles of ubuntu. It is possible that the harsh realities of life in the village bring forth negative traits instead of the positive. One Elder declares:

> *Ukulamba kuzala ubugebengu (Mr Zitha, FGD May 2010).*
> {Poverty breeds crime}.

Knowledge of Mqatsheni thus has natural, historical, socio-economic and even spiritual dimensions. The people value their place. They belong to it and love it in spite of the challenges it faces. The future, for the young people, is an opportunity to serve the community – a signal of strong connection to the place even among the youth.

The strong connection that the people of Mqatsheni have with their place resonates with that of Indigenous peoples elsewhere in the world (as in Aikenhead 2001; Chinn, 2007; Michell, 2005). The sense of place permeates people's identities, as *the Zulu people of Mqatsheni*. When the people moan that they have been 'disconnected' from the land (through restrictions to go to the mountains, for instance), the disconnection is more than a physical process. It is a cultural deprivation that negatively affects the process of knowledge creation, as we shall see in the following section on cultural practices.

Science education is not helping relieving the community of deprivation of everything that they hold dear. The knowledge of place that the students have accumulated could be a resource for science teaching and learning.

6.2.2 Cultural practices

Another form of knowledge in Mqatsheni is that which comes through common cultural practices. Participants report that initiations, traditional Zulu games, poetry, song and dance as well as rituals associated with consulting departed ancestors are a part of life in Mqatsheni. However, some practices seem to have been more prevalent in the past than at the time of the study, as suggested by participants' use of the past tense. Continuity of cultural practices from past into the present and possibly into the future, is suggested by the knowledge that the youth have.

> *Indawo yakithi yayidume kakhulu ngamasiko. Amanye asenzeka lamanje…nengoma futhi ivukile kakhulu. Intsha isukumile ihlangene.* (Ms Majozi 12 May 2010).
> {Our place used to be famous for cultural practices. Some are still being practised…Song and dance have been revived. The youth have come together on this}.

Poetry also comes naturally for some students, and they use the poems to bring out important community issues for example Daniel's poem on page 139, in which he presents the devastating effects of the loss of respect.



Figure 6.4: Traditional dance equipment: drums (*izigubhu*), sticks (*induku*) and shield (*ihawu*)

Traditional games, according to the Elders are not solely for entertainment. Games are a vehicle through which social rules, values and acceptable ethical practices are taught. *Induku* (stick-fighting) is one such game that emphasises honesty and discipline through the strict following of rules:

> *Ngoba akufuneki ukukhipha igazi ngokungafaneli...Kufanele alwe ehlule ngamandla, hayi ukukhipha igazi. Futhi mabemhlanganyela bengu* two *abafana, cha. Akufuneki lokho. Ilwani* two*. Osehlulekile uhlulekile (Mr Zitha, 28 May 2010).*
>
> {It is not permissible to deliberately shed blood. The contestant must fight and win honestly because of physical strength, not by shedding blood. No two boys are allowed to fight against one. That is not allowed. Only two should fight. Whoever loses has genuinely lost}

In the past, games were used to transmit knowledge and skills from the champion of the age group (*ingqwele*) to the rest of the boys. From amongst the younger boys, an *ingqwele* and leader would later emerge, and he would also train the younger ones in the same skills, rules and values. Research studies in indigenous games have pointed to their value, such as in developing confidence, mental capability, physical fitness, tolerance, cooperation, respect, hard work and commitment (Mosimege. 2003; Nxumalo

& Semple, 2013; Nyota & Mapara, 2008; Roux, 2007).

The youth in Mqatsheni are playing a leading role in reviving indigenous games. Skhumbuzo, (one of the research assistants for this study), used experience gained while he was working for the Department of Sports and Recreation to introduce indigenous games in Mqatsheni. The list included both sporting and non-sporting games: *umlabalaba*[41]*, amagende*[42]*, induku*[43]*, arigogo, dibeke,*[44] *ingqathu*[45] *and ingoma.* The youth like the games and they have been negotiating with local schools for the adoption of Indigenous games as part of the local extra-mural activities. In one of the sessions with participating students, the girls played *ingqathu*, singing as they skipped. The principal confirms the importance of traditional Zulu dance (*ingoma*) among the students at his school. He reports that in the past students have organised themselves to enter and have won traditional Zulu dance competitions without assistance from the teachers. Young men and women have also taken part in poetry, song and dance and usually perform at weddings and other celebrations. Of late, the Sisonke Municipality (under which Mqatsheni falls) has also shown encouragement of these practices by arranging for dance festivals and competitions.

Some of the data pertaining to cultural practices suggest gender imbalances which favour males. In writing about respect, the female students suggest that they relate to their male counterparts as they would to Elders (e.g. not looking them in the eyes when talking to them). No similar obligations are there for males. In addition, although both boys and girls undergo initiation, only girls are tested for virginity[46] (*ukuhlolwa*). However, girls are reportedly voicing resistance to the practice of virginity testing, saying it is abusive, discriminatory and outdated.

Although the youth are showing resistance to some cultural practices, religion still has a strong presence in the community. Resistance to some practices indicates the power of the diffusion of new knowledges and the opening up of new knowledge spaces notwithstanding the questioning of cultural knowledge and positions. The future survival

[41] A board game
[42] A coordination game: player throws one stone in the air and collects 10 others in ones, twos, threes or more before catching the one in the air.
[43] Stick fighting
[44] A ball and running game.
[45] Rope-skipping
[46] Virginity testing is a Zulu custom where older women regularly check to see if girls are still virgins as a way of discouraging pre-marital sex. It is an embarrassment to the family for a girl to be discovered not to be a virgin while still unmarried.

of contested Indigenous Knowledge is contingent on negotiating boundaries through careful explanation of the importance of the practice, something that is not common in cultures where for centuries 'dos' and 'don'ts' have been adequate for promoting or for deterring behaviour. IK is in a state of struggle against modern knowledge among Mqatsheni's youth, and a possible survival strategy could be extending the boundaries of its methods to include explaining why certain practices are important and helpful and why others are not. While some education research has advocated for drawing on Indigenous cultural practices like games (e.g. Mosimege, 2003; Nxumalo, 2011), science education could do more. Cultural practices could be a rich resource in science teaching and learning, not because of content that matches that of science, but the variety of practices that could be used in enhancing teaching methods. Poems; song and dance; the religious orientation could be drawn on to enrich students' science learning experience. However, some cultural orientations (for instance patriarchy) could create unequal relations amongst students, and this could inhibit learning. In considering IK-science integration, it is necessary to carefully think not just in terms of science-like IK, but also in terms of what has potential to promote, and what has potential to inhibit learning.

A surprise in the findings is the absence of detail on traditional healing which is commonly cited in South African literature (e.g. De Beer & Whitlock, 2009; Hewson, Javu & Holtman, 2009; Washington, 2010). The participants' silence on traditional healing must not to be construed as absence of the knowledge. The questions that I posed and the way I posed them could have influenced what information participants chose to share, and in this case they chose not to share information on traditional healing. Besides, traditional healing constitutes protected knowledge. It is consistent with transformative participatory research and indigenous research methodologies to respect participants' decisions on what they want to share and what they would rather keep to themselves.

6.2.3 Religious knowledge

As is the case with knowledge of place, an important dimension to knowledge as cultural practices is the spiritual connection. Data about religion came through follow ups and deliberation on traditional huts. Students completed the worksheet shown in Appendix 11. Responses to this worksheet revealed profound connections between the people and their traditional religion.

The traditional Zulu huts found in almost each homestead in Mqatsheni are the centre of connection with the spirits of the ancestors. The ancestral spirits are variously referred to as: *amadlozi* (ancestral spirits), *abaphansi* (those who live below), *abakini abangasekho emhlabeni* (your relatives who are no longer on earth), and *abantu abadala* (older people). They (ancestral spirits) are understood to reside only in grass-thatched huts, and the living can communicate with them through burning incense (*ukushisa impepho*). All participating students indicated they wanted to build some parts of their homes the traditional Zulu way in keeping with the Zulu tradition:

> *Amadlozi kumele ahlale endlini yotshani ngoba uma siwakhela izindlu zesiNgisi awahlali kahle. Baye bathi ayagodola. Manjena kubalulekile ukuthi sakhe izindlu zesintu* (Daniel, Feb 2011).
>
> {The ancestors must live in a grass-thatched hut because they are not comfortable in modern houses. [The Elders] say they (the ancestors) would feel cold. Therefore it is important to build houses in the traditional way}.

The ancestral spirits are understood to be closely connected to the living. They possess the qualities of the living. They are 'Elders' and 'relatives', only not visible any more. They are a part of the day-to-day life of Mqatsheni, similar to Jegede's (1995) observation that supernatural forces play a significant role in daily occurrences. The spirits of the departed, as expressed by the students, are believed to retain some human traits in the after-life: they can be *talked to*; they *do not like* modern houses, but are *more comfortable* in traditional Zulu huts because they *will feel cold* in modern houses. It is ironic that the government is building modern houses for the residents of Mqatsheni, a project that clearly excludes the ancestral spirits. The Mqatsheni housing project raises questions around the *valuing* of indigenous knowledge by the government in terms of practice.

Practical knowledge in Mqatsheni, particularly knowledge relating to the construction of huts, is therefore strongly linked to the community's cultural practices, and the huts serve as the point of meeting of the living and the once-living.

> Ibalulekile ngokuthi iyona insika yomuzi ngoba ihlala abantu abadala. Umuzi awubukeki kahle uma ungenayo indlu yesintu (Wiseman, Hut Worksheet 2011).
>
> {It (traditional hut) is important because it is the pillar of the home because the old people dwell in it. A home is not complete if it does not have a traditional hut}.

Wiseman's profound use of metaphor of a pillar directly corresponds with the Elders' view that if one does not have a grass hut, then s/he does not have a home (see conversation on page 129).

The survival of the practical knowledge and skills of building grass-thatched huts is connected to the spiritual. As was observed by Mbiti (1969) about the strong religious orientation of African people, religion plays a very important part in the lives of the people of Mqatsheni. It is as if:

> …there is no formal distinction between the sacred and the secular, between the religious and non-religious, between the spiritual and the material areas of life. Wherever the African is, there is religion: he carries it to the fields where he is sowing seeds or harvesting a new crop… (Mbiti, 1969, p. 2).

The strength of the connections between the people and their ancestral spirits, especially expressed through living together, shows the extent of the influence of religion in the lives of the people of Mqatsheni. It is of great significance to this indigenous knowledge research study that the youth (student participants) know and participate in many of these cultural and religious practices. This much knowing by the youth points to the importance of these cultural practices for the community of Mqatsheni, and that the practices are being passed on to the present generation of young people. There are strong indications that the same knowledge will be passed on to future generations. Participants sometimes make reference to Christianity as in Category C of Table 6.2, or in singing a hymn and praying the Christian way before the FGD. However, connections with the ancestral world seem to show a stronger presence than connections with Christianity.

The knowledge of the people of Mqatsheni cannot be understood apart from their spiritual beliefs. Western knowledge, including school science is presented as 'sanitised' of the spiritual (Horsthemke, 2004) and hence tends to exclude students who have a strong attachment to their religious values. However, it is very likely that the students in Mqatsheni carry their religion to the classroom. Studies carried out in South Africa have shown that Black students often struggle to reconcile their religious beliefs with the content of Western science (Cameron, 2010; 2007), and it is likely that the students in Mqatsheni may be facing similar problems. Science teaching and learning in contexts such as Mqatsheni and elsewhere need to involve deliberate efforts at identifying and accommodating students' religious beliefs. If the presence of the students' religious beliefs (which in many cases are at odds with science content) is not acknowledged in the classroom, the students may feel alienated from the learning process. The effects of failure to acknowledge students' religious and cultural views in science learning may not just be that students will fail to engage meaningfully in learning. A more subtle and long-term effect might be the loss of knowledge and practices as they will be persistently viewed as not valuable in the modern world.

6.2.4 Practical skills

Another form of knowledge that comes through in interaction with the community of Mqatsheni is practical knowledge (skills). For the purposes of this study, I define practical knowledge as the ability to make or do things. Skills differ according to gender. Men make things from animal skins, wood and horns. Women work with grass, beads and clay. The items that I saw in homes at the time of the study include reed mats (*amacansi*), clay pots (imbiza / *izinkamba*), shields (*amahawu*), grinding stone (*ilitshe*), drums (*izigubhu*) and serving platters (*ugqoko*) (see Appendix 12).

A more common practical skill present in Mqatsheni is the construction of traditional huts. At the onset of my fieldwork (August 2009), all homesteads in the village were benefitting from the construction of four-roomed modern houses under the government's Reconstruction and Development Programme (RDP). A few days before my first visit the area experienced a severe storm that damaged numerous houses. What caught my attention during my maiden visit was that there seemed to be more damage to the newly constructed RDP houses than to the Zulu-style built ones. The local ways of construction seemed to be more appropriate for the local weather conditions.

During the subsequent field trips I had the privilege of seeing huts being constructed in the traditional Zulu way. This became a window through which I had a glimpse into traditional Zulu architecture (Figures 6.2 and 6.3). The construction of these huts relies on special skills from both men and women. The men construct the frame and the roof of the hut from wood and thatch grass (as in Figure 6.2 on page 120). The women make the walls from rectangular blocks of earth cut out of the soil, held together by mortar and stones (Figure 6.3 on page 120). The roofs and walls of these huts are made from materials that offer "…good thermal control: cool when hot, very convenient for winter" (Uncle Mike, October 2010).

Almost every homestead has at least one traditional grass-thatched hut, and these huts are highly esteemed. The Elders express concern that the 'new' systems of land tenure deprive them not only of grazing and arable land, but it is also becoming increasingly difficult for them to get thatching grass:

Mrs Xaba:	*Akusekho utshani bokwaka.* {There is no more thatch grass}.
Mrs Luswazi:	*Sesinenkinga!* {We now have a problem}.
Others:	*Inkinga sibili.* {Indeed we have a problem}.
Mrs Luswazi:	*Uswele uze uswele okokufaka esiswini. Uswele nendawo yokuhlala?* {You have nothing to eat. You have nowhere to stay}.

Others:	*Ye-e* {Yes}
Mrs Luswazi:	*Uzohlalaphi? Izindlu zotshani zingamagugu ethu*. {Where will you stay? Grass huts are priceless to us}.
Mr Duma:	*Ye-e. Zona ziphelile*. {Yes. And they (grass huts) are now few}.
Mrs Luswazi:	*Ngamagugu ethu*. {They (grass huts) are precious to us}.
Mr Zitha:	*Ye-e. Yigugu* (others nod in agreement). {Yes, they are precious}.
Mrs Luswazi:	*Indlu yotshani!* {A grass hut}.
Mrs Xaba:	*Ngitsho kwabangaphandle, indlu yotshani iyigugu. Nakithina yigugu ukungena indlu yotshani. Ma ungenayo indlu yotshani awuna muzi.* {Even for outsiders [to this community], a grass hut is precious. And to us it is important to enter into a grass hut. If you do not have a grass hut you do not have a home}.
Others:	*(*nod their heads in agreement).

(FDG May 2010).

The above excerpt highlights the importance of traditional huts for the participants. For instance, Mrs Luswazi sees the lack of thatching grass as a problem that probably carries the same weight as lack of food. And this is in spite of the fact that many homesteads have benefited from the government RDP houses. So the problem she is expressing may not have been lack of physical shelter, but rather spiritual shelter, since ancestral spirits can only stay in traditional grass-thatched huts. The Elders use variations of the adjective "*igugu*" (precious / priced / important / cherished) four times in this passage with reference to grass huts, and each time the word is used there is agreement from the rest of the Elders, confirming grass huts as having greater significance than the demonstration of practical knowledge and skills. In many of the conversations with the Elders I noticed the way they echoed each other's statements (as in the excerpt above). This repetition and agreement seems to suggest a culture that promotes unanimity, as explained by Hamminga (2005).

The skill of hut construction is likely to survive well into the future not only because the huts can withstand adverse weather, but also because of the connections of the huts with the spirits of departed relatives. Participating students indicated a willingness to build traditional Zulu huts when they grow up, and they all cited connection with *amadlozi* as the reason for doing so. The lesson that science education could learn from Mqatsheni is in showing recognition of the students' spiritual connections. Basing on a study in a South African tertiary institution, Cameron (2010) argues that recognising students' spiritual connections could encourage border crossing into the culture of

science. It is possible that students in Mqatsheni could benefit from science teaching that recognises their spiritual backgrounds.

For decades now, Mqatsheni has been suffering loss of practical skills related to farming. Participants say that Mqatsheni and neighbouring communities used to be famous for crop farming:

"*Indawo yakithi ibinombuso ngenxa yokulima*" (Ms B. Majozi, May 2010).

{Our place used to be famous in terms of agricultural production}.

We were actually the bread basket of Underberg. They used to come and buy food from us (Uncle Mike, October 2010).

At the time of the study, the cultivation of land for crop production was a thing of the remote past for the majority. The only semblance of cultivation was in small patches for vegetables and occasionally some maize, hardly a quarter of an acre in size. The reasons given for not farming include: the coming of large estate plantations; designation of some former communal land into state land under the UKhahlamba Parks Board; cross-border livestock theft and land being overtaken by invasive plants. These factors, according to the Elders, have had the combined effect of reducing both arable land and grazing land, the result of which has been less and less farming over the years since the 1970s. The picture of the future regarding farming at a subsistence level is dim:

*Yikhonake, ukulima sekuze kwaphela kithina. Sekuphelile nakubantwana. Abantwana abasazi lutho ngokutshala, ngokulima. Sesinovalo ukuthi isizukulwane esizolandela sizogcina singayazi inkomo, singayazi imbuzi, singalazi igusha, ngoba kuyaphela (*Ms Majozi, May 2010).

{As a result farming has ended for us. It is over even for our children. The children know nothing about planting and about cultivation. We are afraid that the coming generations will end up not knowing a cow and not knowing a goat or a sheep, because we will not have them}.

In addition to the causes for the gradual decline of farming in Mqatsheni, outlined above, Uncle Mike thinks the lack of emphasis on farming and other practical skills that came with modern schooling negatively affected the traditional Zulu practice of crop farming:

Uncle Mike: Our parents, you know, they weren't earning much, but then they saw education was the thing for everybody. They took us off the farm because it [education] was for a better position for yourself in life. They forgot that they could educate us in agriculture itself so that we could come back and utilise the land properly. That's where the huge mistake was. That's why the majority of guys around my age went up to the mines, went up to the towns rather than

farming. And from that time you started seeing the slide – lacking of production in the place. And today it's at a standstill. Today it's at a standstill.

Constance: So book education kind of removed people from the…?

Uncle Mike: Yes. It removed people from the soil because they looked at it the wrong way! I think they looked at it as if agriculture was a suppression of the people, yet it wasn't.

Constance: At which point in time can you recall noticing people stop farming?

Uncle Mike: In the 1970s. In 1976 when I went to for tertiary education, and I keep coming home and I see the land has not been dug up – you coming from outside now and see, "Why isn't that done? Why isn't that done?" And it started showing from then. Our place was the most productive I know in the area. Everybody admired it…you go there today and look at it, you see clumps of clay and wattle around it – it's an eyesore! So in the seventies you start to really see it coming, that the people aren't interested in the soil anymore…It's been because they look more to education and other cultures. It really pulled them away because people can get food from the shop. Why must I produce if I can just pick it up at someone else's?

(Interview October 2010).

Apart from the pursuit for education, farming also lost appeal due to the convenience of buying instead of growing their food. A lot of knowledge of Nature (*ulwazi lwemvelo*) has got lost in Mqatsheni as a result of people not tilling the land, and such knowledge could have been useful prior knowledge especially in Life Sciences. When people are actively involved in farming (or any other activity that draws people close to Nature), they get to develop 'hands-on' knowledge on life processes involving plants and animals. Learning these processes in school science would then serve to give the students a scientific view and could make school science more relevant to students' lives.

Although there is very little crop farming happening in Mqatsheni today, practical skills regarding food preparation remain. Students report eating foods such as *isigwamba*[47]*, uphuthu*[48]*, isijingi*[49]*, amasi*[50] *and ujeqe*[51]. These foods are associated with the traditional Zulu diet. Knowledge of traditional foods could help in understanding some Life Sciences concepts.

[47] A mixture of cooked corn meal and *imifino* (herbs).
[48] Cooked corn meal.
[49] Cooked pumpkin made into a kind of thick porridge by adding maize meal.
[50] Fermented milk.
[51] A type of bread made from flour and crushed fresh mealies.

Valued artefacts

Despite the loss of some practical knowledge and skills needed for making traditional articles, through this study, I found artefacts that are highly valued in Mqatsheni. Many of such artefacts have symbolic significance. For instance, reed mats are a significant part of the collection of articles that a bride brings into her marriage home. Platters are used to serve food (especially roasted meat) to older men. Some Elders are still able to make these articles. Some older women can make reed mats, but none of the participants can make clay pots. Some artefacts were passed on as an inheritance from older generations. For instance, Mrs Luswazi inherited two clay pots (Figure 6.5) from her paternal grandmother through her late mother. The pots were made before Mrs Luswazi's father was born and had been in use since then. Mrs Luswazi also inherited a serving platter (Figure 6.6) from her grandfather. It is common for the people to buy articles that they value but which they cannot make on their own.



Figure 6.5: A collection of inherited artefacts: a wooden platter and clay pots placed on reed mats



Figure 6.6: A serving platter that was passed from two generations before

Other artefacts are kept for future generations. An example is the set of (the straw bowls and ox-horn spoons (Figure 6.7) belonging to Mr Zitha. These utensils are not regularly used, but Mr Zitha has kept them for his grandchildren and their children.



Figure 6.7: Straw bowls (*unyazo*) and dishing spoons (*izikhetho*) made from cattle horns

The Elders' valuing of the different articles suggests an intimate relationship with the culture of which the articles are a symbol. This is evident in both the safe-keeping and use of these artefacts for decades. Although in many homes, families use 'modern' utensils, they still keep and treasure the traditional ones.

Interaction between Zulu culture knowledge and modern ways of living has in some ways negatively affected the survival of skills for making traditional household articles. The Elders reported a general lack of interest in both making and learning to make these household items because there is either too little money or no money at all that they will earn from making them:

Mr Zitha: Umthelela yilel' ibala elokuthi ungatholi inzuzo. Usebenzelani? Ungatholani? Ngoba into enkulu asidli. Umsebenzi awukho. Nezingane ozifundisileyo uhleli nazo, zidla wena. Uzatholani?

{The problem comes from not making any profit. Why do you work? What will you gain? Our major concern is that we have nothing to eat. There are no jobs. You still have to provide for the children that you sent to school. What will you gain?}.

Mrs Luswazi: Akhekho ozokuthenga.

{No one will buy the thing}

Mr Zitha: *Akhekho ozokuthenga.*

{No one will buy}.

Ms Majozi: *Ma usukwakhile, kuzothengwa ngubani?*

{When you have made it who will buy it?}

(FGD May 2010).

The Elders explain that they gave up culturally related skills in pursuit of gainful employment. As a result, the will to learn practical skills waned, for instance in the case of Ms Majozi below:

Ms Majozi: Naminje angikwazi [ukweluka amacansi].
{I too do not know [how to make mats]}.

Others: (laughter)

Ms Majozi: Kodwa umama wami ubeluka.
{But my mother could make them}

Others: (nod in agreement)

Ms Majozi: Ngokuthi bengingakuboni kunenzuzo, bengingakunakaka.
{Because I did not see it as profitable, I did not pay attention [to learning]}.

It is possible that in the past (when the current Elders were still young and had greater opportunity to learn), there were greater chances of paid employment then, and young women and men took up employment in towns and cities and learnt little if anything of the traditional practical skills. As was the case with farming activities, it is also apparent that modern schooling disrupted the transmission and learning of these skills instead of enhancing them. Perhaps the skill of hut construction survived not just because of its connections to the spiritual, but also because it is lucrative, particularly for those who have the skills of thatching.

The few Elders who are able to make things are willing to teach younger people. They express willingness to work with the school on imparting traditional skills. It is worth noting that while some practical skills and factual knowledge have been lost, values and spiritually related cultural practices remain and are likely to be passed on to the next generation.

The brewing of traditional beer (*umqombothi*) that is cited as an example of 'indigenous science' in the NCS Physical Sciences subject statement (DOE, 2003b), was not mentioned by any of the participants. The references to alcohol in the data are not specifically about traditional beer, and none of the participants claim they have the skills

to prepare it. The Elders complain about young people abusing alcohol, and the students mention beer as a distraction from focusing on their life goals. However, the absence of data on traditional beer should not be taken to imply that the practice no longer exists. It might be that the participants associated beer with negative behaviour and so they may not have wanted to reveal the practice of brewing beer as part of local knowledge.

6.2.5 Language

IsiZulu is the key factor that runs through all knowledge in Mqatsheni, and it is through isiZulu that the knowledge was shared during this study. Outside of school premises, the participants usually speak only isiZulu.

As pointed out earlier, the participating students had a choice of writing in either isiZulu or in English. The students worked on 14 tasks that involved writing (this included free writing, questionnaires and worksheets). The number of students who submitted varied with tasks, but a total of 314 responses were submitted (Table 6.2). Of these, 143 (45.54%) were in isiZulu and the rest were in English. I observed that earlier during the study, the students chose to write in English more than in isiZulu. Their inclination towards English changed later during the study, probably after noting that writing in isiZulu was acceptable. When students chose to write in isiZulu they expressed themselves clearly and in very rich language. I mostly used the isiZulu responses from the students in reporting the data. Very often students made use of powerful similes and metaphors:

> *Ngifuna ikusasa eliqakazile* (Philile, 2011).
> {I want a blossoming future}.

> *Ngiyafisa sengathi ikusasa lami liyaqhakaza libe lihle njengezimbali zasehlobo* (Daniel, 2011).
> {I wish my future could blossom and be beautiful like summer flowers}.

> *Ikusasa akulona elabazali bakho, ngokuba umuntu nomuntu kumele azimele. Ixoxo nexoxo liyazigxumela (Nkululeko, 2011).*
> {The future is not your parents' [responsibility], because each person must stand work for himself/herself. Every frog has to make its own leap}.

Table 6.2: Language choice in writing tasks

TASK	Total responses	Responses in IsiZulu	Responses in English
A knowledgeable person in our area	24	21	3
Photograph assignment	29	25	4
Food in our area	29	0	29
Museum worksheet	13	5	8
Poems	15	13	2
What I would show a visitor to Mqatsheni	15	13	2
The important things that I learnt from home	17	14	3
My future	48	24	24
Interview project	25	0	25
Things I wish to understand better	6	6	0
Questionnaire on rain	19	1	18
"Snakes and Ladders"	29	3	26
Conceptions of respect	29	8	21
Hut worksheet	16	16	0
Total	**314**	**143**	**171**

In Mqatsheni, the prevalence of isiZulu could be one point of hope for the preservation of Indigenous knowledge. The language itself communicates much traditional wisdom, and young people are still capable and willing to communicate in isiZulu. Responding to a question on what talents Jacq thought local people possessed, she was quick to point out: confidence in making oral presentations and in music (which they do in isiZulu). Jacq also pointed out that the problem was that "there are no outlets for these talents" (Jacq, 20 January 2011). Science education and science education research both have the capacity to contribute to the sustainability of Indigenous languages through greater recognition and use. In a study where students were given the opportunity to hold discussions in their home languages in a science class, Msimanga and Lelliott (2013) observed that the use of Indigenous languages does not impede students' engagement with science concepts. It is possible that similar observations could be made in Mqatsheni if communication in isiZulu were to be given a chance in science learning.

6.3 Values and worldview

The room that was used for science classes was an ordinary classroom furnished with four rows of two-seater desks. The furniture was enough for about fifty students, but the class had 21 girls and 9 boys. This classroom was not overcrowded as is commonly said of rural schools. The teacher's table and chair were in a corner directly opposite the entrance. There was an assortment of textbooks and stationery on the teacher's table, behind which, and standing against the wall, was a steel cabinet, probably storing books and other valuables.

None of the students sat alone. They preferred sharing the desks at the back of the room, sometimes in threes, leaving the front rows unoccupied.

(Journal entry, October 2009).



Figure 6.8: Students in the science classroom

Values stood out as prominent for the people of Mqatsheni, and like language, values connected the different forms of knowledge. The values emphasise the importance that the people place on relationships. This emphasis on relationships provides a segue through which to examine the participants' worldview - their understanding of

themselves, the world and their place in it. It is on the basis of worldview that we have an understanding of what the world is really like, and what constitutes valid knowledge about the world (Cobern, 2000). Our worldviews are shaped by our socio-cultural contexts, and they can influence cognitive processes (Nisbett, Peng, Choi & Norenzayan, 2001). In the next sub-sections, I present and discuss findings on the constituents of worldview that informed and shaped the community's Indigenous knowledge. Pointers to worldview came through the participants' values.

The participants' values were key in pointing to their worldview. Throughout the study, emphasis on values was present in formal conversations, in informal conversations as well as in students' writing. Respect, honesty, gratitude and caring for others were frequently mentioned by the students (for instance in Daniel's poem on page 140 below). The Elders emphasised respect and collective responsibility over children.

Nhlonipho

Nhlonipho wayaphi?
Abantu abaningi wabalahlekela.
Kusobala ukuthi wavela wacela impunzi,
Ngoba lelilizwe lonke likhala ngawe,
Nhlonipho.

Kusobala Nhlonipho ukuthi usadliwa izintaba.
Buka manje izingane, amabhungu, izintokazi
Zilahlakelwe nguwe Nhlonipho.
Kumanje kuphuma imiphefumulo ngenxa yakho?
Woye lafa elihle kakhulu!

Nhlonipho usulahlekele ngisho nezingane ezikhasa phansi.
Nhlonipho ngikakubona ngingakubeletha!

(Daniel Chagwe, Grade 10 in 2011)

Respect

Respect, where have you gone?
Many people have lost you,
It is clear you have fled
This whole land is in mourning because of you, Respect.

It is clear, Respect, that you have been attracted to the mountains,
Look now, the toddlers, lads and beautiful women,
They have lost you, Respect.
Is it not a long time since lives have been lost because of you?
Oh! Our beautiful land has perished!

Respect you have fled even from crawling children,

Respect, if I see you I will not let you go!

The students want to be honest and trustworthy; to be respectful (respecting both self and others); to help and to care for others (both family and the greater community); and to be grateful and to return with good the kindness shown to them. Self-respect, care for the family and for the community is at the centre of the students' concerns. In writing about their future, for instance, 18 out of the 24 students who participated in this activity repeatedly referred to "helping", "assisting" and "supporting" their immediate family as well as the wider community. I quote a few examples below:

> *Ngifisa sengathi umasengisebenza ngingawukhohlwa umdeni wami – ngiwukhumbule njalo kanye notisha baKwaMvimbela kanye nabasePhosimbi, ngibabonge ngempilo yami. Ngiyobonga kakhulu abazali bami ngendlela abangikhulise ngayo ukuze ngibe kuleyondawo engiyobe ngikuyo kuleso sikhathi. Ngizosiza izintandane kanye nabo bonke abadinga usizo (Siyanda, MF 2011).*
>
> {I wish that when I will be working, I would not forget my family but continuously remember them, together with teachers at KwaMvimbela and Phosimbi. I will especially be grateful to my parents for bringing me up to the position that I will be at that time. I will help orphans and any others who need help.}

> *Ngiye ngihlala ngithandaza sonke isikhathi ngicela inhlonipho ngoba ngikholelwa ukuthi uma uhlonipha uyaphumelela ezintweni eziningi (Nondumiso, MF 2011*).
>
> {I always pray asking for respect because I believe that if you are respectful, you succeed in many things}.

> *Mina ngifuna ukuba ngumuntu oqotho emphakathini, ngisize umphakathi, ikakhulu intsha* (Mondli, 2009).
>
> {I want to be an upright person and to help the community, especially the youth}.

The students do not envision a future that is all about themselves as individuals. Their imagined future is in terms of how they will contribute towards the common good, and how they will return the good done for them as they grew up. It is possible that the students' orientation towards caring, giving and such other values, is prompted by a desire to give the 'right answer'. However, since these opinions were expressed in an individual writing activity, it is more likely that these ideals are close to the students' hearts. It is also possible that these ideas of wanting to help and to care for others, and of wanting to express gratitude, were prompted by the students' own life experiences where other people had shown them kindness. For example, Bonakele outlines her plans to help orphans and at the end adds the following 'addendum':

Ngizokwakha ikhaya lami libe lihle, ngibonge noGogo wami owangikhulisa. Ngijabulise abazali bami lapho bekhona, ngibabonge ngokuthi bangiletha emhlabeni – noma uNkulunkulu enganginikanga isikhathi eside ngihlezi nabo (Bonakele, MF 2011).
{I will build my home and make it beautiful, and I will thank my grandmother for raising me. I want to make my parents happy, wherever they are, and I will thank them for bringing me into this world – even though God did not give me a long time to live with them}.

It is common for students to include their personal experiences in their responses to given tasks, as is the case with Bonakele (above). She makes reference to her experience of being an orphan. Bonakele longs to please her deceased parents, an indication of how deceased relatives are believed to be part of the lives of the living. Bonakele's expression of gratitude towards her grandmother and deceased parents is set to continue into the future, as suggested by her use of the future tense. Relationships are therefore central for life in Mqatsheni, and the key elements governing those relationships are being respectful; being honest; showing gratitude; caring for and helping those in need.

The values held by the participants sometimes reflect consideration of family before the individual. For instance, some girls mention marriage and chastity as meant for family pride, or so that their parents may receive *lobola* (bride price). One girl indicates that she wants to protect her virginity till marriage, so that her parents may receive full bride price of a herd of eleven cattle.

Collective co-existence also manifests even in people's Zulu names (see Appendix 6). The Zulu names reflect relationships in the social, physical and spiritual realms as in the examples and translations below:

- Nomvelo (mother of Nature)
- Nozinhle (mother of beauty)
- Xolisile (asked for forgiveness)
- Fanelesibonge (we must be grateful)
- Mbulelo (revelation)
- Mondli (care-giver)
- Sibongiseni (Help us to be thankful)
- Lungisani (make peace)

Zulu names suggest that at a social level, values such as relationships, harmony and gratitude are encouraged. Some of the names also suggest the people's closeness to

Nature and to the spiritual realm. The meaning of Mbulelo for instance, is suggestive of 'coming to know' by revelation and or intuition – a way of knowing that is significantly different from the Western way of *seeking* to know.

6.3.1 Respectful social relationships

Chief among the values emphasised in Mqatsheni is respectful relationships. In all conversations, Elders make constant reference to respect, and students mention respect, for instance, when writing about their future and when writing about the important things they have learnt from home. The students are aware of the importance of being respectful. They express a sense of responsibility to respect themselves, and to respect those who are older and also those who are younger than them. When writing about respect, the students' references to older people seem to emphasise relationships between the younger and the older people in which the younger are regarded as respectful when they silently carry out instructions. For example, it is a sign of respect for students to:

- quickly carry out an older person's instructions without question,
- not answer back to an older person,
- not complain when given work to do,
- listen to an older person speaking even when they are saying something not desirable, and
- accept it when an older person tells them that they are wrong.

In both FGDs and interviews, the Elders repeatedly complained that the children were not according them the respect that they [the Elders] deserved.

> *Inhlonipho iphelile kubantwana. Namhlanje abamazinje umuntu omdala ukuthi uyini* (Ms Majozi FGD, October 2010).
> {Children are no longer respectful at all. Today they [children] do not recognise what an older person is}.

> *Kuqala bekuqamuka umuntu omdala athi "Mfana, wozala". Ugijime uze kuyena. Afike athi "Gijima uyevimba leziya nkomo uzilethe", uhambe uyevimba lezo nkomo. Awumazi, kodwa umqoqele inkomo* (Mr Zitha, Interview May 2010).
> {In the past an adult would come and call you and you would run to him. He would instruct you to run and stop his cattle from straying. You would run and carry out his instruction, even if you did not know him}.

> *Bayasitshela abantwana bethu. Thina sasingabathsheli abazali. Sasilalela. Sihambe ngalowo mgudu* (Mrs Mlibeni, FGD, October 2010).

{Our children answer back at us. We would not answer back at our parents. We heeded [instructions]. That is how we were brought up}.

According to the Elders, the children now have the audacity to answer back to their parents and to question taboos, something that was unimaginable in the past. Young people are said to no longer observe taboos and food restrictions that were imposed in the past, as part of raising children during adolescence.

Therefore, although both the older and the younger participants agree on the importance of respectful relationships, the older generation believes the younger are not according them respect. This perception from the Elders is probably because their [the Elders'] definition of respect is one which stems from a structured hierarchical society where Elders are at the apex and children at the bottom. Such respect as shown in the examples that the Elders give, is driven by fear of punishment. The censure on physical punishment has disempowered the Elders who seem to have no alternative methods of discipline. As a result, while in principle the community's collective understanding of respect involved unquestioning obedience from the younger generation; there was evidence throughout the study, that in practice, that definition is now being interrogated by the youth.

The issue of respect thus presents multiple understandings of one phenomenon. The older people think of respect in terms of fear, while the youth perceive respect as one's responsibility to self as well as to others – where others could be social, physical, or spiritual. As a result, Elders emphasise that respect has been lost, while young people reiterate the importance of respectful relationships.

The Elders express different opinions on why respect has been lost. Some Elders look at the macro system outside of Mqatsheni and blame democracy (child rights and the right to vote at eighteen years), and others think the source of the problem is internal to the community – starting from the family. The two perspectives are exemplified below:

La enhlonipheni, nohulumeni unawo umthelela ukuthi abantwa bethu babe yinto abayiyona, bangasezwa, bengahloniphi, ngoba baze babe nezwi lokuthi (mhlawumbe la ekushayeni nasekuhlolweni kwezintombi), "Liyasihlukumeza bazali. Leyonto yayiyenziwa kinina. Thina siyisizukulwane salesi sikhathi manje". Uyayizwa lonto? Ngoba uhulumeni uthi ingane azisashaywa (Mrs Mlibeni, FGD October 2010).

{With regards to respect, the government has a hand in what our children have become – disobedient and disrespectful. They even say (for example on matters of corporal punishment and virginity testing), "You are abusing us, parents. These things were meant

for you. We are today's generation". Do you understand that? (*directing the question to me*). Because the government says children may not be beaten].

Inhlonipho iphelile. Futhi ma ubuka, ayiphelile kubona [abantwana] kuphela. Iphele emuva lapho ephuma khona – ekhaya. Singashonje ukuthi abantwa bethu abahloniphi, kodwa nasekhaya inhlonipho iphelile namhlanje. Abasayitholi nasekhaya inhlonipho, okokuthi kubalulekile ukuthi abazali uqobo bavuse inhlonipho bona emakhaya (Ms Majozi, FGD October 2010).
{There is no more respect. But if you look at it closely, it is not just the children who are no longer respectful. There is no more respect in the homes where the children come from. We may say the children are no longer respectful, but even in our homes there is no respect today. The children are no longer taught respect at home, so it is important for parents to revive respect at home}.

I see both explanations for the loss of respect as equally valuable in providing an understanding of the changing sociocultural context of Mqatsheni. On the one hand, the imposition of sanctions against corporal punishment has disempowered the Elders. In addition, the same laws have resulted in children taking undue advantage by not having accountability, and hence suffering little consequence for their behaviours. It is ironic that child-protection laws (for instance protecting children against abuse) have seemingly not provided any effective protection against sexual abuse[52] that has resulted in the prevalence of teenage pregnancies. The Principal confirms that students as young as 13 years are falling pregnant and many end up dropping out of school as a result. One teacher estimates that more than 50% of the girls in Grades 10 -12 are "already mums". On the other hand, the claim that respect is waning at family level is equally important. There are verbal reports of child sexual abuse and other forms of violence, some of which might be perpetrated by older family members (also reported in Ntleko, 2012). Such reports do confirm that respect and *ubuntu* indeed need restoration at family level.

It is likely that the Elders who view the loss of respect as being caused by external social structures feel that their authority has been undermined by interaction with the new value systems that came with democracy in South Africa. As a result they feel

[52] The term 'abuse' here has a double meaning. The first one is the common one of minors being forced into sexual relations with other minors or with adults. The second is where minors abuse their 'freedom' and take part in sexual relationships. Both forms of sexual abuse contribute to the problem of teenage pregnancies.

powerless to deal with the disciplinary problems that they face as a community, hence they appeal for external help:

> *Mina bengithi nawenje (addressing me) - ngoba unazo ingane – keufake leli vangeli. Mhlawumbe zizake zizwe makusithi kunobuso ezingabujwayele* (Mrs Luswazi, October 2010). {I suggest that you too *(addressing me)* – because you also have children – you may also preach this gospel [of respect]. Maybe the children will accept the message coming from an unfamiliar person}.

Those Elders who think the problem of the loss of respect is caused by internal causes suggest local solutions, where Elders will hold regular 'workshops' with the youth teaching about respect and related Zulu ways of living. These 'workshops' would be gender-based (as was the case with traditional initiations).

Although the Elders think that respect is waning among the youth in Mqatsheni, my experience of working with the students suggests that they respect our participatory relationship. The students worked on agreed tasks, worked responsibly with given equipment (e.g. cameras), and were well behaved in all the activities done with them. The principal confirmed that the students are disciplined and are not involved with drug abuse as is common with other young people in the area. Jacq also voiced similar sentiments (but in a tone that showed concern):

> I find relationships with staff very formal. I worked in Ireland for more than ten years, and my relationship with colleagues was on a plane level. Here it is very different. Staff take authority's words as God's word – no discussion (Jacq, 26 January 2011).

It is likely that Jacq was able to make this observation because of her different cultural experience. The local perspective applauds the absence of deviation from authority as respectful.

Although there are differences in opinion as to the prevalence of respect, the value still stands out as very important in the lives of both the elderly and young participants. They believe that, "all things are built by respect" (Nobesuthu, October 2010). For the community, a human being should be an embodiment of respect. Greetings, for instance, are an acknowledgement that people matter, whether stranger or well known, old or young. The students and Elders emphasise greetings as a sign of respect. One Elder captured the importance of greetings in Mqatsheni:

> *Abantu bala basakwazi ukubingelela umuntu. Kwezinye indawo umuntu akasabingelelwa* (There is agreement from other Elders)*. Umbingelela ngoba umazi. La, noma uyamazi, kumbe awumazi, uzombingelelanje umuntu* (Mrs Luswazi, 12 May 2010).

{The people in this area still greet. In other places they no longer greet (There is agreement from other Elders). They greet only the people that they know. Here, whether you know the person or not, you just greet the person}.

For the participants, the importance of a person does not depend on what is known about them. Just being a person (*umuntu*) is enough to command recognition through greetings. Greeting someone shows they are welcome and cared for, and points to *ubuntu*. The full greetings in isiZulu (between hypothetical people Londiwe and Siziwe would go like this:

Londiwe: Sawubona {Hello}
Siziwe: Yebo. Sawubona {Yes. Hello.}
Londiwe: Unjani? {How are you?}
Siziwe: Ngiyaphila. Wena unjani? {I am well. How are you?}
Londiwe: Nami ngikhona. {I am well too.}

Ngiyaphila is generally translated as "I am well" but it literally means "I am living". A variation of *ngiyaphila* is *ngikhona*, which literally means "I am here". Greetings in isiZulu are about life and living. They go beyond asking about a person's physical health to asking about life in its totality, which is a way of showing care.

Respect in Mqatsheni extends beyond human relationships to relationships with the natural and spiritual worlds (see Table 6.1) for a summary of students' conceptions of respect). What I find significant for science education is not simply the importance of respect as a phenomenon, because every society would naturally value respectful relationships. It is rather, the way in which participants in the context of my study understood these respectful relationships that I see as having great significance for science teaching and learning, because such understandings influence the way teachers and students interact in the classroom.

Table 6.1: Variations in students' conceptions of respect[53]

CONCEPTIONS OF RESPECT	
Category	**Examples**
A: *Respect is silent acceptance of instruction*	• When an older person sends you, you do not answer back, you carry out the instruction. • Do not answer back to an older person. • Not complaining when given work to do. • Listen to an older person speaking even when they say something you don't like. • Listen to the older person and don't argue with them. Do what they tell you without answering back. • Quickly carrying out instructions. • Listen to your parent when they are telling you something important. • Listen to your teacher. • When the elder tells you that you are wrong, don't you dare answer to what he is saying. • Do not refuse to do what he or she (an older person) instructs you, and you must run to where he or she has sent you.
B: *Respect as interacting with others according to social practice*	• To say greetings. • An older/elderly person, when you are talking to them, they are not stared in the eyes, you look down; and [the same applies] when a girl when is talking to a boy. • You show respect by not looking an elder in the eyes when you are talking to them. • We show respect by not standing when we talk to an older person. • Having dialogue and raising good ideas. • To listen to others. • Not fighting others. • To give older their place. • An elderly person if he is drunk, it's not said he is drunk. It's said he has eaten and is full, or he is driving goats. • Do not do anything in the presence of elderly people that would be viewed as disrespectful when older people see you do it. • If you are being called by an older woman you say, "Mama". • To respect is part of life because if you do not respect it means you grew up in a home that has no respect. • You do not call your brother by name if he is married. • We all need to respect each other. • If respect was not there, or if we had not been raised through respect then this world in which we live would not have respect • We do respect every single person in this world; no matter how old he/she is we have to respect. • In our culture we don't use the rights which says that everyone in equal.

[53]The responses in the table were translated from isiZulu for easier analysis.

C: *Respect as securing the future*	*Social dimension* • If you respect everyone your dignity is not removed. • Respect play a huge role in our lives • To build ourselves and our dignities. • We respect because we want to be respected in return. • It is important to respect everything and people. • Respect is the one that makes a person see themselves as able to live together with other people. • To respect is part of life. • If you do not respect it means you grew up in a home that has no respect. • We all need to respect each other. *Spiritual dimension* • We respect every people because we want our ancestor to give us luck. • We respect everyone so that God can give us blessing and help me. • We respect because we want our ancestors to give us luck. • So that God can give us blessings. • Because it is said if you respect your days of life will be increased.
D: *Respect as care for the environment*	• Because everything in the world is needed and wanted e.g. tree to get medicine. • I can respect people and other things in the community e.g. animal because in animal you get meat and you get milk. • We also conserve our nature and water. • Not destroying things that are useful to us and the community. • I respect my nature like water, trees. • It is important to respect everything. • In our community we have lot of conserved things. • In our heritage sites we respect it for the new generation to see it.

(Khupe, Keane & Cameron, 2012)

Table 6.2 shows that the students in Mqatsheni understood respect in four ways:

- as silent acceptance of instructions,
- as interacting with others according to accepted social practice,
- as caring for the environment, and
- as having the function of securing the future

A detailed description of the analysis of these conceptions and how they play out in the classroom is given in Khupe, Keane and Cameron (2012).

Science education and science education research could benefit from paying attention to conceptions such as those held in Mqatsheni, particularly Category A (Table 6.2). Learning in general, and in science in particular, is ideally driven by curiosity which is usually expressed through asking questions. The way students in Mqatsheni understand respectful relationships may not encourage the curiosity that would enhance meaningful learning. Jacq confirmed this observation when she expressed concern that none of her colleagues had ever asked her about her home country. There are many possible reasons why no one asked any questions. Probably, Ireland was beyond the

imagination of these young men and women. Probably Jacq's colleagues did not want to know anything beyond what they knew already, or they actually lacked confidence to ask her because of language barriers. Whatever the reason might be, there is an uncomfortable link between Jacq's observations and the way students understand respect as following given instructions and not asking questions. In addition, I have already mentioned in chapter 5 my observation of the students' hesitancy to speak and ask questions. Although there could be other reasons for their silence, the connection with their conceptions of respect cannot be ignored.

Notably absent in the data on respect (from both students and Elders) are ways in which the older members can show respect to younger people. The community order of things is that young people are obliged to relate to older people in respectful ways, thus strengthening hierarchies in social relations. Although this social order is firmly established and has been working for centuries, it may have negative implications for teaching and learning, as students may feel inappropriately positioned to meaningfully engage in their own learning.

The data in this study suggests that the individual in Mqatsheni is expected to interact with fellow community members within the boundaries of what is culturally acceptable (Category B). The criteria for what is respectful behaviour is not set by the individual but is socially determined by those in positions of power and authority (the Elders). The individual (particularly children), are not appropriately positioned to modify those criteria. In any case, the data also shows that respect is sometimes prompted by fear of authority, as shown by the Elders' constant reference to corporal punishment:

> [*Inkinga] yikuthi ingane azisathintwa kulezi nsuku kwaqala ukusabalala. Thina sasishaywa. Ngoba wawukwazi ukuthi "Maye! Nangu uBaba!"* (she buries her head in her hands) (Mrs Shezi, Interview, May 2010).
>
> {[The problem] is children can no longer be punished physically these days. We used to be beaten. You knew [the implications of] "Oh! Here comes Father!" (*she buries her head in her hands*)}.

Although respect is valued in Mqatsheni, it shares an uncomfortable space with fear (particularly the fear of physical punishment). One Elder noted, *"inhlonipho ngumuntu" {respect' is the human being}* (Mr Shezi, May 2010). In other words a person who has no respect has lost the essence of being human. They have lost *ubuntu*. The students are aware of the importance of respect, and they relate it to both their present social relationships and to their future wellbeing. The students cite respect as one of the

important things they have learnt from home and consider respect as critical for their future success.

6.3.2 Respectful relationships beyond the social

Respect secures the future

The data reflects a connection between respect and the future (Table 6.1, Category C). Respectful actions in the present are understood to yield security for the future. Participants understand respect as a form of investment in two dimensions: the social and the spiritual. While respect manifests mainly in social relationships, expected rewards or sanctions will be experienced in both the social and spiritual realms. These 'dimensions' are reflected in what is said by both students and Elders:

> We respect because we want to build our dignity (Nobesuthu, 2010).

> We respect because we want to be respected in return (Nonsindiso, 2010).

> *Kumele uhloniphe ngoba inhlonipho iyimpilo futhi iyikuqhubekela phambili (Doreen, 2010).*
> {You must show respect because respect is life and it is progress}.

> *Ingane kufanele zihloniphe abantu abadala. Ehe. Ukuze zibe ngabantwana abayoba nekusasa elihle* (Mr Zitha, 28 May 2010).
> {Children must respect Elders. Yes. So that they may have a good future}.

Both the students and the Elders agree that the quality of one's future life is determined by the level of respect the person shows in the present.

Being respectful also secures the future in a spiritual way. The participants refer directly and indirectly to God and ancestors who reward respectful behaviour and impose sanctions against disrespectful behaviour. The following examples illustrate this point.

> *Ngoba kuthiwa uma uhlonipha izinsuku zakho zokuphila ziyakwanda* (Lindiwe, 2010).
> {Because it is said if you respect, the days of your life will be increased}.

> If you don't respect anyone you cannot succeed in all you do (Nozintle, 2010).

> Because we want our ancestors to give us luck. We respect everyone so that God can give us blessings (Nomvelo, 2010).

So respect in relationships in Mqatsheni does not end at the social level. It extends to the spiritual, and the spiritual dimension determines a person's fortunes. The social and the spiritual are inseparable, and securing the future demands that one has a sense of agency. The individual has to make the choice to act or not to act respectfully, but having full awareness of associated outcome.

Respect cares for the environment

Respectful relationships in Mqatsheni are understood to include the natural environment (Table 6.2, Category D). Being respectful involves caring for the natural environment which gives from itself to humans. Participants appreciate and seek to reciprocate gifts from nature through respectful use and care:

> We respect because everything in the world is needed and wanted e.g. tree to get medicine (Sibongiseni, October 2010).

> *Nezilwane nazo ngizihlonipha…kanye nezintaba ngoba zihlobise umhlaba* (Agrineth, October 2010). {I respect the animals and the mountains too because they make the land beautiful}.

Respect and educational outcomes

In Mqatsheni, respect is understood as linked to educational outcomes. Students cite respect as an important factor for success in school, and Elders observe that children who lack respect cannot succeed because they are difficult to teach. The consequence is, according to the Elders, that children just go through the schooling system and come out barely literate:

> *Uma ungahloniphi uzafundiswa ngubani? Ngoba nalo othi uyakufundisa uyamphoxa* (Mr Zitha, 28 May 2010).
> {If you do not respect, who will teach you? Because you demean the one who wants to teach you}.

> *Nasesikholeni…sebephasiswanje ingazi lutho ukubhala. Ngani? Ngoba azisahloniphi otisha* (Mr Shezi, 28 May 2010).
> {Even at school…they are now just let through the system although they cannot write. Why? This is because they [the children] no longer respect teachers}.

Although respect appears in the literature on science teaching and learning (Khupe, Keane & Cameron, 2012; Slaton & Barton, 2012), there have not been any suggestions that respect could be a cause of poor learning outcomes, especially in the South African context where learner performance is below the expected levels for the majority of

students. The relationship between respect and learning as understood in Mqatsheni could inform not just science teaching and learning, but could also inform school improvement efforts.

School science does not ordinarily include the dimensions of respect discussed here. Since both Elders and students view respect as an important factor of success in life in general, and in school in particular, it is worth considering the inclusion of the value in science teaching and learning, particularly through teaching methods that value and respect students' life experiences and opinions.

6.3.3 Collective responsibility

Another important value and pointer to the participants' worldview is collective responsibility. Just as was the case with respectful social relationships, data from the Elders seem to suggest that collective responsibility was more important in the past than it appeared to be at the time of the study. The Elders recall that when they were growing up, social relationships were much stronger than they are now. Prominent in the way in which people related was reciprocity. There used to be collective responsibility in teaching and raising children. The older a person was, the greater the responsibility they had over family and the community. At home, the children were not only the responsibility of their older family members, the whole community was responsible for raising them. When they were out in the mountains, herding cattle for instance, the youth were under the guidance of the leader of that group (called *ingqwele*), training them to be responsible for each other:

> *Kwakuyindlela eyayinjalonje ukuthi ingane bezifundiswa ukuphathana. Kwakukhuliswana. Kwakunjalo* (Mr Zitha, Interview May 2010).
> {That was the way that children were taught to care for each other. We were responsible for the other's growth. That is how it was}.

Mr Zitha uses the reciprocal extension forms of the verbs 'to care' (*ukuphathana*) and 'to grow' (*kwakukuliswana*) to emphasise the importance of valuing co-existence and looking to each other's interests that was evident in the past. Then, everyone was responsible for everyone else. Corrective discipline, as the Elders reported, was the responsibility of all adults. Misbehaviour resulted in punishment (mostly corporal) by any adult. In the past, as the Elders reported, age gave one legitimate authority over younger people. In the example below (and several Elders gave similar examples), Mr Zitha explains the authority and privileges older members of society enjoyed over young people in the past:

Uma kufika umuntu omdala elusile iyinkomo noma yini…leyonto izasala kuwena. Usuzambhekela. Ahlale phansi yena, omunye abe esendlala ijazi lakhe alale. Kodwa uyovuka zikhona. Ngoba uma esezihlnganise nalezi ezakho usuzazibheka wena. Avukeke, "Ziphi ezami?" Naziya mkhulu. Azithathe aziqhube ahambe. Uvela ukuyayelusa kanti ube eselusa ehleli. Akelusanga (laughs) (Elder Zitha, 28 May 2010).

{If an older person comes, herding cattle or any other animals, he will hand them over to you (younger person) and sits down or even lies down and sleeps. It becomes your (the boy's) duty to ensure the older man's herd does not stray. When he wakes up he drives his herd home. It is as if he has spent the day herding cattle, when in fact, he was just seated. He did not herd the cattle at all (*laughs*)}.

The elderly person could actually lay off his responsibilities onto the little boy. Mr Zitha's story and the others like it, do not contain good examples of respectful modelling. Although this treatment of children could have been part of training for collective responsibility, the method brings to question the essence of caring and protection of children.

In the past, older people were responsible for enforcing appropriate behaviour to those younger than they, even when the older person was a stranger. It is likely that there was greater trust that all adults meant well and so the parents would not question the punishment of their child by a stranger. Also, the children would not dare report to their own parents for fear of facing a second round of punishment, because their parents would not have believed an adult could just beat up children for no reason. The adults were thus portrayed as responsible and acting in the best interests of both the children and the community at large:

Ngoba kuthiwe ubengeke alisukele umuntu omdala . Ubengalishaya kanjani? Ikhona into ebe niyiyenza. Nempelake likhona iphutha alibonile…Kwakunjalo. Kwakuyinhlalonje eyayinjalo. Abantu babebhekene. (Mr Zitha, 28 May 2010).

{Because they would say he would not just have beaten you up for nothing. How would he? There surely is something wrong that you were doing. That is how it was. That was the way of living. People looked after each other.}

The order of life in the past therefore suggests that adults took responsibility for children and the rest of society. People looked after each other ("*abantu babebhekene"*). Although the authority that the adults had over children seemed to arouse fear in the children, the participating Elders still valued the positive results that the fear achieved for them:

Kanti thina sasishaywa noma ngubani. Ungahlangana naye endleni usenza into embi sasishaywa. Manje thina siqoqekile ngalendlela enjalo. (Mrs Shezi, 28 May 2010).

{We were beaten up, by whomever. If you meet him/her (older person) while you were doing something wrong, they would beat us up. And we are disciplined because of that}.

6.3.4 Collective co-existence

The individual person in Mqatsheni does not view themselves as existing as independent beings. The individual exists with and for others. Participants express thoughts about themselves as individuals always in relation to the family, and to the broader community. The students want to work for the good of the community. Their aspirations for the future start with getting a good tertiary education which they reason will propel them to better living standards for themselves, their families and their community. Individual improvement is for the sake of family or the whole community. The students view themselves as part of a community, positively contributing towards its development. They have a strong sense of belonging to the community, in both the present and the future, and they view themselves as active in finding solutions to the social problems faced by their community, as in the examples below.

> Ngifisa sengathi uma sengisebenza ngingawukhohlwa umdeni wami (Siyanda MF, 2011).
> {I wish that when I am working I should not forget my family}.
>
> Umasengiphumelele kulezi zifiso zami ngingashintsha umuzi wasekhaya ngiwakhe kabusha (Koleka MF, 2009).
> {When I have succeeded in these things I will rebuild the family home}.
>
> Ngifisa ukwaka iClouds yezintandane ngoba zisanda namanje ngenxa yogciwane lengculazi. Emakhaya amaningi kugcwele izingane ezingenabazali mhlawumbe lomuntu oshonile bekudliwa ngaye ekhaya, bekunguye kuphela osebenzayo ekhaya, uNkulunkulu ephinde amthathe kusale kulanjiwe ekhaya (Philile MF, 2011).
> {I would like to build an orphanage because they (orphans) are increasing because of HIV and AIDS. In many homes there are many children without parents. It is possible that the deceased was the bread-winner, the only one employed, but God has taken them away and there is starvation in this home}.

The individual is thus very strongly attached to the community. Students have a vision of working in their community and make a difference there. They do not consider using education and employment as stepping stones to get out of the community. Rather, they look to education and employment as opening possibilities for improved life in the village. As argued in Khupe, Keane & Cameron (2009), Mqatsheni could benefit from a curriculum that considers local needs. Not many of the young people leave Mqatsheni after school, probably because of the scarcity of job opportunities in the cities; hence the

NCS goal of preparing students for tertiary education and employment does not apply in this context. Schooling could benefit locals more if the curriculum prepared them for local conditions, for instance through subjects like Agricultural Science.

People who are regarded highly in Mqatsheni are those that contribute towards the community good, for instance, through:

- helping people in need,
- sharing knowledge,
- caring for the elderly,
- protecting children and those in society who are vulnerable,
- upholding Zulu culture,
- developing local talent, and
- promoting a caring attitude in the community.

The principles of ubuntu have a strong presence in the community and are strongly valued. The students appreciate that the benefits flowing from the knowledge bearers can be tangible or simply empowering, as in the example below:

> Umuntu onolwazi olubanzi endaweni yakhithi umuntu owazi ukuphathwa komphakathi kanye nezinkinga zawo. Umuntu onolwazi umuntu owaziyo ukuthi umphakathi umele uphathane kanjani uwodwana noma uphathane kanjani emdenini yabo. Lomuntu uyakwazi ukuthi umphakathi ukwazi ukuhlalisana ngendlela efanele kungabikhona omunye umuntu ongenakho ukuthola, aphinde abanike indlela yokunikana uthando emphakathini nokwamukela izifiki (Lucia KP , 2011).
>
> {In our area, a person who has extensive knowledge is one who knows how to lead the community regardless of all its problems. A knowledgeable person is one who knows how members must relate to each other, and how they must relate within their families. Such a person knows how to help the community live in peaceful co-existence, so that there is no one in desperate need. The person will show them the way of demonstrating love to others, and to welcome visitors}.

In the above example and in others like it, the promotion of peaceful relationships is very important.

Another pointer towards collective co-existence comes through the use of collective pronouns when participants make reference to Mqatsheni. There is no reference to Mqatsheni as “my area” or “this area”, but rather, as “our area”, which point to collective ownership of the land. Phrases such as “indawo yethu” (our place), “endaweni yakithi” (in our place), and “umuzi wakithi” (our home), were commonly heard from both Elders and students. This collective ownership of place is consistent with the use of knowledge

for community benefit as well as the emphasis on social relationships - respect, caring and collective responsibility. Because the people belong together, they work for the common good. This finding is similar to Keane's (2008a; 2006a) studies where participants defined their personal goals in relation to their community rather than themselves as individuals.

Social relationships in Mqatsheni show the ideals of ubuntu as described for instance, by Kamwangamalu (1999); Venter (2004) and Mnyaka and Motlhabi (2005). The participants closely match observations by Mnyaka and Motlhabi (2005:221) that "the African individual is a communal being, inseparable and incomplete without others". Although he does not use the term ubuntu, Mbiti's (1969) description of the relations amongst African people closely matches ubuntu:

> Only in terms of other people does the individual become conscious of his being, his own duties, his privileges and responsibilities towards himself and towards other people. When he suffers, he does not suffer alone but with the corporate group; when he rejoices, not alone but with his kinsman, his neighbours and relatives whether dead or living…What happens to the individual happens to the whole group, and whatever happens to the whole group happens to the individual. The individual can only say "I am, because we are; and since we are, therefore I am." This is a cardinal point in the understanding of the African view of man (Mbiti, 1969: 108,109).

It is to be noted that the ideals of ubuntu are under threat in Mqatsheni, and communal living and care are endangered. Reports of crime and corruption are not consistent with the harmonious picture of traditional African life. Letseka (2013) bemoans the same loss of ubuntu among the Sotho people in South Africa. Therefore, although the Elders disapproved of child protection laws that came with democracy, the traditional cultural methods do not appear to have adequately protected the defenceless in the last few years.

6.3.5 Relationships with the natural world

For the people of Mqatsheni, the natural world is superior, and gives generously to meet human needs. It was common to hear descriptions of both natural and human-made phenomena as helpful and beautiful, and as closely connected with the spiritual. The appropriate human response to nature's providence is to be respectful and to care for the natural world.

6.3.5.1 Nature is helpful

In a task in which students described photographs from the Mqatsheni countryside, the students repeatedly used various forms of the verb 'to help' (*ukusiza* in isiZulu) to

describe the vegetation, animals and buildings. The students did not describe human-made items as made by people for given purposes, but rather as helpful (Table 6.3). What strikes me as very significant is the way the students relate what they see in the pictures to either people in general, or to themselves (although none of the photographs have people shown). Some examples of the photographs that the students worked with are shown in Figure 6.8.

Table 6.3: Students' understanding of Nature

Category	Examples
A: Nature is helpful	• Trees are important to people because they help them [people] get many things. • Trees help in making exercise books and medicines for the cattle. The fence is helpful because we protect our homes with it. Grass is helpful because animals eat it • I see trees as the ones that help us now that we do not have electricity. The other ways in which they [the trees] help us is that we can use them for constructing dwellings, fences and kraals. Some trees help us to get books [for use at] school. • Huts are helpful. Grass-thatched huts are even more helpful…Cattle are helpful…Trees are helpful. • A cow must to be taken good care of because it is helpful to us. A cow must be taken care of because it is helpful. A cow needs to be taken care of so that it stays safe because it is helpful to people.
B: Nature is beautiful	• How beautiful this calf is! There is beautiful grass near it [the calf]. • What is in the picture is our big and very beautiful mountain. All the mountains in our place are beautiful and have a beautiful green colour.
C: Nature is understood from a holistic perspective	• Mountains are very important because for many creatures [mountains] are like their homes, because there are many different animals that live there. They [animals] are part of God's creation. [Mountains] are not to be set on fire because [animals] will die when grass is not there. • The picture shows the importance of Nature because from Nature we get medicines from trees. From grass cattle get food and [other] animals get food and a place to live. • The grass is helpful because animals eat it and because they live by it". • A cow is very important to all people because [from it] we can get milk and also get meat. We can slaughter for and give our ancestors cattle meat. • This home has been damaged by strong wings seven times. Luckily no one died as a result of those disasters. The owners of that home have slaughtered cattle [as an offering] to prevent the disaster.

*Some of the responses were translated from isiZulu.



a



b



c



d



e



f



g



h



i



j

Figure 6.8: Sample of pictures used for photograph assignment

In the extracts below (relating to Figure 6.8a and 6.8b) the students express a strong sense of dependency on Nature, as well as a sense of responsibility:

Inkomo kufanele inakekelwe ngoba inosizo kuthina. Inkomo kufanele inakekelwe ukuze ihlale iphephile ngoba inosizo kubantu (Fikile, PA 2011).
{A cow must to be taken good care of because it is helpful to us. A cow needs to be taken care of so that it stays safe because it is helpful to people}.

Ngibona izinkuni zakwa SAPPI kanye nomshini wokuzisika. Lezinkuni bekade zitshalwe lapha…seziyasikwa…seziyokwenza umsebenzi othile njengokuthi ziyokwaka amaphepha kanye namapulangwe. Ngicabanga ukuthi lezinkuni ziyakwazi ukusisiza thina njengabafundi. Zisisiza ekutheni singaphelelwa yi material yesikole (Nomzamo, PA, 2011).
{I see the logs that belong to SAPPI and the machine used to cut them. They were planted here… they are going to be cut…they are going to do some work, such as making paper and timber. I think these logs are capable of helping us as learners. They help so that we do not lack stationery}.

Nature gives, and the people receive. People are subordinate in relationship with, and not dominant over Nature. They are privileged beneficiaries of nature's generosity; hence they do not necessarily have authority to make decisions about whether or how to exploit nature. In none of the students' responses are there any suggestions of an attitude of conquest over nature:

- *Trees help* in making exercise books and medicines for people and cattle; for constructing huts, fences and kraals and for firewood.
- *Grass is helpful* because animals eat it.
- *Huts are helpful* because they shelter people from rain
- *Chickens give* eggs, meat and manure

6.3.5.2 Nature is beautiful

Another pointer to worldview that came through the students' responses in the photograph assignment is the aesthetic view of Nature. The grass, mountains, flowers, cattle and ducks are described as beautiful. This comes at the forefront of the students' descriptions of the photographs. Figures 6.8c, d, e and f all command admiration from the students, and the expression of their beauty comes right at the beginning of the descriptions. For example,

Lihle lelinkonyane! Eduze kwalo kunotshani obuhle (Phililе PA, 2011).
{How beautiful this calf is! There is beautiful grass near it [the calf]}.

Okusesithombeni yintaba yangakithi enkulu futhi enhle kakhulu. Zonke izintaba zangakithi

zinhle futhi ziluhlaza kahle (Siphesihle PA, 2011).
{What is in the picture is our big and very beautiful mountain. All the mountains in our place are beautiful and have a beautiful green colour}.

The students demonstrate closeness to Nature in their use of possessive pronouns, such as Siphesihle's *"intaba yangakithi"* (*our* mountain). Therefore, nature is not some 'distant' phenomenon. The students are in a close relationship with Nature. They can appreciate its beauty. In an outstanding case of such valuing of aesthetics, Nkululeko takes a step further from writing a description of the photograph, to composing a poem that is directed at the flower in Fig 6.8d:

Wamuhle mbali kwangathi ngingakuthatha ngikubeke ekhaya
Ngendlela omuhle ngayo.
Wamuhle kwangathi uwena imbali yase Africa yonke.
Ubukhulu bakho, ukuma kwakho, indawo okuyona ifanele wena.
Ngifuna ukwazi owasungula wena (Nkululeko Mazeka[54] PA, 2011).
{How beautiful a flower you are
I wish I could take you home because of your beauty.
How beautiful you are - it's like you represent the whole of Africa
Your size, your stature, the place where you are is just fit for you.
I want to know who made you}.

The close relationship with the physical world is also evident among the older members of the community who often describe Mqatsheni as a beautiful place and as a place that they love. The same intimacy was described by Uncle Mike when he talked about his experiences on the farm:

> We were born into the farm and the next thing you look out you see chickens you know you gonna feed them. You do that and keep them. You grow straight into nature. That's how I grew up…It's like a language, you know. You're born in that language; you live that language…The cows were like friends. Each one had a different name. You would call them and they would walk up to you (Uncle Mike Interview, October 2010).

Although practices that would normally bring people closer to Nature (such as farming), are no longer prevalent in Mqatsheni, the participants' relationship with the natural environment has endured. That relationship with Nature could be a good resource for science teaching and learning, especially in the environmental aspects of Life Sciences.

[54] I have included the author's surname here because two boys named Nkululeko participated in the study.

6.3.5.4 The importance of spirituality

The world in Mqatsheni has physical, social and spiritual dimensions. People live in co-existence with, and are interconnected to the living, once-living and non-living elements of nature. For them, nature is *uNkulunkulu's* (God's) creation. Ancestral spirits are believed to live among the people and partake in the activities of the living. Communion with the spirits of the departed is through burning incense and directly speaking to them, for example if there is illness or other disaster in the family. The spirits are believed to participate in celebrations, such as, when children graduate from initiation and during wedding celebrations. The people attach 'sacred significance' (Aikenhead & Michell, 2011) to mountains, rivers and huts.

The participants' reference to uNkulunkulu in this context does not necessarily suggest reference to Christianity. Many African peoples are known to believe in an Almighty Creator-God, who, although known by different names in different languages, these names point to the same deity (Mbiti, 1969).

6.3.5.5 Nature is interconnected and interdependent

In Mqatsheni, the world is not viewed as isolated parts. This is especially evident in students' responses to the photograph assignment. Although the task was for the students to describe what they saw in the pictures, they went on to include their experiences of the area, much of which was not shown in the picture. A typical example is Daniel's description of Figure 6.8h.

> *Amahlathi abalulekile ngoba [kuwo] kune zilwane. Amhlathi angamakhaya, azo njengenyoni nengulube zawo amahlathi, nezinye eziningi. Nabantu bayasizakala kakhulu lapha emakhaya ngoba lapha emakhaya awukho ugesi. Ngakhoke inkuni kuzona ezisebenza kakhulu ikakhulukazi ebusika – kuyabanda, liyakhithika linongqweqwane. Inkuni zisebenza kakhulu. Ziwusizo njengalapha eMqatsheni. Kuyabanda kakhulu lapha ekhaya. Nezilwane makuthiwa likhithikile zingena khona emahlathini zihlale khona zibalekela amakhaza. Ngakhoke amhlathi abalulekile kakhulu ebantwini nasezilwaneni (Daniel PA, 2011).* {Bushes are important because there are animals [in them]. The forests are their [animals'] homes, for instance, birds and wild pigs and many others. People also get help here in the rural areas, because there is no electricity. As a result firewood is most important, especially in winter – it is cold and there may be snowfall. Firewood is most helpful here in Mqatsheni. It is very cold in this place. Even the animals, after snow fall, they get into the forest and stay there – hiding from the cold. Therefore forests are very important to people and to animals}.

Like many of the students, Daniel's description focuses on the interconnections between

parts of the environment, which though not shown in the photograph, are within their life experiences. The photograph assignment provided the kind of open spaces that allowed students to express their ideas without thinking that they must give 'correct' answers. Their focus on the interrelationships suggests a holistic view to nature, where any individual components are seen as parts of a whole. People are part of this holistic picture – "part of a world in which plants, animals and natural features are alive with ancestral and spiritual significance" (Chinn, 2007:1250). This interconnectedness emphasises people's responsibility to care for the other living and non-living parts, for instance by not burning grass (Figure 6.8i).

> *Utshani bubaluleke kakhulu ngoba izinkomo zingazaca uma zingebudli utshani. Ziphila ngabo. Akufanele bushiswe endaweni ekudla kuzona inkomo utshani (*Lindisiwe PA, 2011).
> {Grass is very important because cattle may become thin if they do not eat grass. They live by it. Places where cattle graze must not be set on fire}.

In Mqatsheni no single part of Nature exists in isolation. The social, the physical and the spiritual realms are all interconnected. Studies among indigenous people have pointed to this interconnectedness (Aikenhead & Michell, 2011; Hamminga, 2005; Kawagley, Norris-Tull & Norris-Tull, 1998; Odora Hoppers, 2005). Polly Walker (2013) calls such a network of relationships 'interconnected knowing', while Kearney (1984) calls it an 'ecological consciousness' (p. 74). I summarise the ways in which the people of Mqatsheni understand their relationship with the world in Table 6.4.

Table 6.4: Indicators of worldview among participants

Indicator	**Examples**
Ubuntu (emphasis on relationships)	• Participants emphasise caring, sharing, respectful and peaceful relationships, showing gratitude, community good and a sense of belong to the community. • Collective rather than individual identity. • Students express goals for the future in terms of contributing to the common good.
Closeness to and dependency on nature	• Use of plural forms of possessive pronouns when referring to the place of Mqatsheni or to natural features (e.g. "*intaba yangakithi*" (our mountain). • Description of natural phenomena as "giving" – no attitude of dominance over nature. • Appreciation of the beauty of nature. • Expressing the need to care for and respect nature.
Nature is God-created	• Declarations that God gave the mountains, the springs and the rocks to the people of Mqatsheni.
Reality consists of both the visible and the invisible	• Participants speak of ancestral spirits as partaking in social activities (e.g. marriage ceremonies). • Ancestral spirits have are described as having feelings, and attitudes (e.g. not liking concrete houses).
Close connections with the spiritual	• The presence of the traditional hut (where *amadlozi* are believed to dwell) in every homestead. • Belief that nature is God's creation and that human beings are beneficiaries of God's providence.
Nature is interconnected and interdependent	• Students' emphasis on showing respect to everything "because everything is needed and wanted".
Anthropomorphism	• Khanti Mountain can be consulted concerning wealth.

The ways in which the people of Mqatsheni understand their being and their physical, social and spiritual worlds is significantly different from how these realms are understood from a school science perspective. Firstly, the participants view themselves as existing within a community. Their world consists of the social, the physical, and the spiritual, and the human being is always in a three-way relationship with these. In Mqatsheni, the people attach great value to their social environment, similar to Ji, Peng & Nisbett's (2000) and Nisbett's (2003) findings among Asian populations, where the self is viewed as linked in a network of relationships and social obligations.

Secondly, the people of Mqatsheni relate to each other as part of one community. Individuals do not view themselves as 'self-made', in the sense of Achebe's (1958) portrayal of his main character, Onkonkwo. Individual endeavours are not purely meant for the individual alone, but for the common good. The sense of community prevailed in the past, has survived to the present and is likely continue into the future. As in Hamminga's (2005) metaphor of a tree, the people of Mqatsheni can say:

> …we are one body, a tree. We sing, we dance, we weep, *we know* /…/ A part of a tree does not choose an individual existence…And everything you do, including acquisition of knowledge and coming to beliefs, serves the purpose of enhancing the vital energy, the procreation of the tribe. Together. (Hamminga, 2005, p. 57, 58).

Thirdly, the participants pay particular attention to the beauty of Nature, similar to findings in Keane (2008; 2006a; 2006b), where participants describe cabbages, donkeys and nature as beautiful. Although school science content does not focus on the affective domain, science students in this study have a strong emotional attachment to the world around them. Therefore, students could benefit from pedagogy that values their understanding and ways of relating with Nature.

6.3.6 Areas of tension

It comes up in the data over and over again that some values in the past were prompted by the fear of adults. The Elders report a shift in values especially with the coming of democracy. Changes on the social and political fronts have resulted in changes in society's value system. The Elders feel they no longer have the same authority for what could be presently viewed as "sanctioned bullying", which the generations of Elders before them had. They blame democracy for bringing with it a social order that is foreign to their culture and traditions, and that is disruptive to their way of living. Teaching the youth is now difficult because the adults have been stripped of their traditional authority:

> *Ingane zanamhlanje ngeke usakwazi ukuyikhokhela ngoba ungayishaya uyaboshwa. Seziphethwe ngumthetho (*He shakes his head*). IsiZulu asisekho kahle/.../namhlanje abantu sebebhekwe nabeLungu. Yileyonto sibili yaxova kakhulu* (Mr Zitha, 28 May 2010).
>
> {We cannot manage today's children because if you beat them up you will be arrested. They (the children) are now protected by the law (*He shakes his head*). The Zulu culture has been disrupted…the people are now looked after by the Whites[55], and that has

[55] The reference to "Whites" does not mean South Africa is still under colonial rule. Since 1994, South Africa is under the governance of the African National Congress (ANC). However, in KwaZulu-Natal, there was strong opposition to the ANC that led by the Zulu-based Inkatha Freedom Party (IFP). The tension deteriorated into much bloodshed in the KwaZulu-Natal in the 1990s. The older people still

confused things}.

A new social order seems to have emerged where, instead of the Zulu people looking after each other's welfare; they were now being looked after by the foreign, Western-based legal system. Inflicting corporal punishment on one's child is now tantamount to abuse and hence, a criminal offence. The Elders view the new laws in negative terms. The democratic government (viewed by the Elders as a symbol of Western values and authority) is accused of having interfered too much with local ways of living, and brought with it values that they had not known before. The Elders are sceptical about the motives of these laws. They believe that the post-apartheid government adopted these pro-youth laws to attract the political support of the youth. As a result, this 'vote-buying' totally upset the community's social order and is seen, among other negative things, as contributing to teenage pregnancies, and possibly aggravating the HIV/ AIDS problems.

The male Elders are not only unhappy about child protection laws, but about laws protecting women too. Children's and women's rights (*amalungelo*) are reported as problematic by the male Elders (see chapter 2). Although the women have clearly shown support for the traditional Zulu order with regards to children, they do not verbally respond to the statement about women's 'rights' except by looking at each other and smiling. While the female Elders' silence is suggestive of unequal male-female relationships in Mqatsheni, the silence could also point to how the community dealt with differences of opinion – possibly by avoiding open conflict (as observed in Msimanga & Lelliott, 2013; Nisbett, 2003). The Elders who voiced resentment towards women and children's rights appeared to be the oldest among the members of the TC. The women's silence could also be explained as respect for older members of their community. The incident pointed to gender differences in the acceptance of democracy-related social orders in Mqatsheni.

The situation regarding relationships in Mqatsheni points to the dynamism of knowledge and the tensions that it can create for a community. The dilemma that the Elders in Mqatsheni have regarding child discipline versus new child protection laws symbolises discordant ways of knowing that have had no dialogue to enhance a smooth transition. A legal system has been established to displace a culturally embedded disciplinary system, without seeking to negotiate for a common ground. The result has been a double negative. Firstly, the Elders have been disempowered, but suffer the

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support the IFP while the younger people support the ANC. Therefore Mr Zitha's reference to Whites 'looking after the people' is likely to be in terms of Western values rather than political.

consequences of their children's lack of responsibility through unplanned pregnancies and the spread of HIV/AIDS as described by one Elder below:

> *Ingane ifika igula, awuyazi ukuthi iphethwe yini. Unobuhlungu uyainursa ingane, uyayigeza, wenze yonke into kanti usowuthathake futhi. Kusasa sokugula wena* (Mr Myende, FGD October 2012).
>
> {A child comes ill and you do not know what they are suffering from. You are pained but you nurse them, bathing them and doing everything, not knowing you are also contracting the disease. Tomorrow you will also be ill}.

Many Elders have actually lived the experience described above: nursing their children (sick from AIDS-related illnesses) and in the process contracting the virus and the disease themselves[56]. Secondly, the youth lead an unrealistic lifestyle where there appears to be no consequence for irresponsible behaviour – at least in the short-term. As a result they do not live to enjoy their youth, for instance, when girls fall pregnant at thirteen years and have to take on responsibilities of parenthood. Mrs AN mentions teenage pregnancies as one thing that she does not like about Mqatsheni. She and the principal both estimate that at least 50% of girls in Grade 11 and 12 either have children or are pregnant. What is grave for me is the thought of the possible number of student participants who could have been parents, and what that means in terms of the life chances of these teenage parents and their children.

It appears that there has not been adequate dialogue in Mqatsheni prior to the shift from cultural ways of disciplining children to the more democratic system related to the Bill of Rights. The depth of the Elders' concerns regarding matters of respect and discipline suggest a need for negotiation at the level of the community, as suggested by Sutherland (in Malcolm, Sutherland & Keane, 2008). Almost twenty years into democracy, the male Elders in Mqatsheni are still questioning the motives behind the rights of children and women. This questioning by Elders suggests the need for community-level assisted 'border crossing', in similar ways as Aikenhead (1996) suggests for students in science teaching and learning. Although the constructs of 'border crossing' and 'cultural brokering' are classroom-related constructs, I believe that they could be applied to community level cultural issues as well. Success in negotiating boundaries between closely-held cultural beliefs and "other" ways of understanding could pave a way for easier adjustment to a dynamically changing world. However, these findings regarding Mqatsheni Elders' stance on child discipline bring to question

[56] KwaZulu-Natal Province has the highest HIV/AIDS prevalence rate in South Africa (Statistics South Africa, 2013).

the wholesale celebration of IKS without pointing out problematic elements that compromise on *ubuntu,* protection, care and respect for vulnerable members of the population.

My field experiences revealed that there is more to IK in Mqatsheni than that which can be easily related to school science context - an expectation that was created by the literature. The forms of knowledge in Mqatsheni are underpinned by a worldview that is different from that of the Western science framework, on which school science is based. The data from this study suggests that IK-science integration in Mqatsheni may need to shift in focus away from identifying content that 'looks like science', to creating methods of teaching science that acknowledge students' worldviews. These led me to ask myself: Is focus on science content the way to go with Indigenous knowledge in Mqatsheni? Is focus on IK that suits science content adequate or even appropriate? Would such a focus result in social justice? Can the approach adequately contribute to improved science learning among Zulu students in Mqatsheni? What began as a fairly 'neat' research study grew to having complex findings, quite similar to Sally Morgan's experience while searching for her Aboriginal origins:

> We were different people now. What had begun as a tentative search for knowledge had grown into a spiritual pilgrimage. We had an Aboriginal consciousness now and were proud of it (Morgan, 1987, p. 296).

6.4 Summary

The focus of this chapter was to present findings relating to the following questions:

1. What Indigenous knowledge can be identified from interaction with participants in Mqatsheni?
2. What constitutes the worldview that informs the community's Indigenous knowledge?

The answers to these questions summarise the knowledge and worldview of the people of Mqatsheni. My interaction with the participants in this study showed that they had knowledge in the forms of knowledge of place; cultural practices; religious knowledge; practical skills and language. I also found out that knowing in Mqatsheni is closely connected with values. These values point to a worldview that is characterised by relationships at the social, physical and spiritual levels. Life is therefore understood as interconnected. In the next chapter I present and discuss findings in relation to *what* IK to use in school science and *how*.

CHAPTER SEVEN

SPACES FOR IK-SCIENCE CURRICULUM INTEGRATION

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CHAPTER SEVEN

FINDINGS 2: SPACES FOR IK-SCIENCE CURRICULUM INTEGRATION

7.1 Introduction

In the last chapter, I presented findings pertaining to knowledge and worldview in the community of Mqatsheni. The participants shared values, practical skills, cultural practices (including religion), knowledge of place and language. Not all of the knowledge shared by participants can be described as 'science-like'. Connecting the forms of knowledge in Mqatsheni are strong relationships amongst the people; between the people and the spirits of their ancestors, and between the people and the natural environment. This knowledge survived centuries of interaction with other knowledge systems, and is connected to knowledge holders through the values that they hold dear. It is that knowledge held, valued and needed by the people of Mqatsheni that I examine and consider for integration with school science, in answer to my third research question: *what aspects of the participants' knowledge could be included in school science, and how?* In constructing the answers to this question, I draw from the findings of the first two research questions - detailed in Chapter 6, and from the FET Life Sciences and Physical Sciences subject statements.

7.2 Indigenous Knowledge in Mqatsheni

Relationships are at the centre of life in Mqatsheni. Participants speak about the key values of respect, honesty, caring, gratitude, collective responsibility, and working for the common good. To maintain these values, those in positions of authority sometimes enforce rules and punish disobedient behaviour.

Both the young and the old in Mqatsheni express closeness to the local environment. They appreciate the resources 'given them by Nature': mountains, springs, rivers, grass and animals. They are alert to the effect of natural hazards: strong winds, cold, lightning, and rain. The land and its political histories are part of their lived experience. The history has disrupted their way of life but has not completely severed their spiritual connections. They understand and live the interconnections of the social, the physical and the spiritual. Although disease and death, unemployment and poverty are a reality, the youth show that they have a future to live for – to serve the more vulnerable in their community.

Many participants say that they take part in traditional practices such as *ingoma* (song and dance), and poetry commonly performed at celebratory functions. Traditional rites relating to the initiation of boys and girls as well as virginity testing for girls are also practised. The people of Mqatsheni maintain connection with the spirits of their departed relatives through communing with them by the burning of incense.

Practical skills in Mqatsheni are gender-based. Men work with animal skins, wood and horns. Women work with grass, beads and clay. Both men and women take part in the construction of traditional huts.

7.3 Pointers to Worldview

In this study, I also needed to understand the way participants made sense of the world, that is, their worldview. This is because our assumptions about how the world works shape our knowledge (Cobern, 2000). In order to understand participants' worldview, I analysed their understanding of the individual within the community and within the natural environment.

The individual is not thought of as independent, but rather as dependent on family and community for success in personal endeavours. What family and greater community give is neither 'deserved' nor does it come as a right. The individual appreciates the favour shown. Children, for instance, express gratitude to their parents for bringing them forth into the world, and for bringing them up. The children therefore feel the obligation to give back through service to the community. Relationships are at the centre of the community, and they manifest through emphasis on sharing, caring and respect. Person-to-person relationships in Mqatsheni are guided by the principles of *ubuntu*.

In relation to nature, the individual is a part of a mystical and interdependent system involving natural, social and spiritual life. Their reality consists of both what is visible and that which is not visible. Participants express a collective sense of belonging, as manifested in their use of collective pronouns when referring to their homes and the land. They are aware of their responsibility to care for each other and for the other creatures in the natural environment. Just as the animals do, people express dependence on what nature provides, and hence do not have an attitude of dominion over nature. They see nature as helpful, beautiful and closely connected with the spiritual, all of which are not within the prescribed knowledge strands of school science in South Africa.

7.4 Participants' Suggestions for School Learning

Both students and Elders make suggestions on what could be learnt at school. The Elders suggest practical skills such as crop farming and livestock rearing – skills that would be directly relevant to life in Mqatsheni.

> *Siphatheka kabuhlungu ukubona izingane zethu zihambela ukuyofunda ukuthi zikwazi ukubhala iphenseli kuphela. Sifisa bafundiswe ngezolimo, bangagcini ngokufunda amaphepha, kodwa kube khona iyingadi ezizokwenziwa. Ulwazi banalo olusemabhukwini, kodwa alukho abaluphethe ngesandla…Bona bafunda emaphepheni kuphela kuphelele ephepheni. Kwezolimo sicela bachecheshwe abantwana kukhona, bakwenze practically* (Ms Majozi, FGD May 2010).
> {We are not comfortable to see our children going to school just to learn to write with a pencil. We want them to be taught about farming so that they do not just read from papers. There must be patches of land to work on. They (children) do have knowledge from books, but they do not have any knowledge in their hands. They just learn from papers and it ends there, on the paper. We request that the children be trained in farming so they do it practically}.

> Kumele bafunde imisebenzi yezandla. *Into yonke iyakhiwa ngesandla* (Mr Shezi, Interview, October 2010).
> {They should learn practical work. Everything is made by hand}.

The Elders' raise concerns about the practical value of schooling in its current form – where there is no hands-on application. The 'paper-based' knowledge acquired at school is seen as having little relevance for the community, and neither does it seem to help students outside of the Mqatsheni. Only two students from the school made it to a

tertiary institution in 2011, and opportunities outside of the village remain inaccessible to the majority. The question that begs urgent answers is how education, guided by the current curriculum documents can be made to enhance life chances for the children in a context where communities are "not persuaded that education will change their lives" (Malcolm, 2008, p. 145).

In addition to learning practical skills, Elders single out respect as a value that must be taught in school. This came about as a result of Elders at an FGD continually expressing concern about the loss of respect among the youth. I then asked the Elders' suggestions on how the problem of the loss of respect could be overcome.

> *Into esengaze ibe ngcono mangibheka yikubanje ingane zifundiswe inhlonipho. Ehe. Manje okufuneka yikufundisa inhlonipho, ingabe kusukela kwabo* (Mr Zitha Interview 2010).
> {What could improve the situation, in my opinion, is for children to be taught respect. Yes. Respect must be taught right from home}.

The importance of respect is not simply in its association with Indigenous values. Respect is viewed as a strong determinant of students' success in school, hence explicit teaching of respect is viewed as likely to contribute to better performance outcomes.

For the students, the future is not about one way of knowing, but many ways of knowing. Just as is the case with the Elders, the important factor deciding what should be taught in school is relevance. The content that the students would like to learn more about includes both IK and science-based knowledge (Table 7.1). The students want to know more about environmental issues; manufacturing and technology; as well as practical skills. Issues specific to IK that the students want to learn more about include indigenous plants; constructing huts and preserving food.

A lot of the suggestions about learning in environmental issues that the students make (Table 7.1.) are issues that one would expect they learn in Life Sciences. The students could have included these issues either because they had not covered them in class, or if they had, it may be that the content was not taught in a way that encouraged them to relate it to their lived experience.

Table 7.1: What students would like to learn more about

Forms of knowledge	Example
Environmental issues	• The importance of afforestation • The life processes of trees • The positive impact of the plants from other countries (those trees that reduce indigenous plants and water). • How trees are important to living organisms. • How alien plants affect us • How do the forests help us? • How do Zulu forests differ from other forests? • Why are indigenous plants different from alien plants? • Where do flowers come from? What are their uses? What do we gain from flowers? • Protection against lightning • Preventing drought
Manufacturing and technology	• How to GPS [map] forests • How are forests processed into materials such as timber, desks? • How is paper made? What chemicals are used to make paper? It is very important to teach learners at school about using paper.[57] • Knowledge about cars.
Practical skills	• Building shelter [houses/huts]. • Knowing how much material e.g. blocks needed for a house/hut? • Why do shelters sometimes break down? Can it be prevented? • What causes the floor to crack sometimes? How can you prevent that? • Raising chickens • Preserving food • Farming • Traditional medicines • Protecting our history • Preserving food

In summary, the suggestions made by students and Elders in Mqatsheni about what could be included in the school curriculum are based on what the participants view as relevant for their context. The Elders suggest that young people are taught practical skills as well as to be respectful. These suggestions made by participants on curriculum content point to perceived capacity of the school to do more than what is being done now. The community have hopes that the schooling can help fight the challenges that the community faces. The fact that students endure the long distances, and the cold and

[57] This has implications for the environment if students knew how every piece of paper is related to a tree. It is likely that the students did not know as this statement came as part of the things that students would like to learn more about.

rain going to school, suggest that they do view school as an avenue for better life. The school could serve the community more directly by addressing local challenges through the curriculum.

The teachers support the idea of giving space to Indigenous knowledge in school science. They highlight the differences between IK and science, and in cases view science as "the truth". The teachers support IK-science integration as a means for students to understand science better:

> I think indigenous knowledge should be included in the teaching of science. When we introduce principles, theories and laws of science, there must be a link with the indigenous knowledge they (learners) have. Because sometimes when we are trying to teach, to convince them, to make them understand what the truth of the principle is; or the theory; or whatever what we want to prove to them, then now they (learners) have the questions: "But in our indigenous knowledge, you know that this cannot happen because of this or that". Now it makes a conflict between science and their indigenous knowledge. I think that we must add their indigenous knowledge. That means if we are introducing any (scientific) principle, we make it answer the question of their knowledge and their conflict. Because some of their indigenous knowledge is just things that they believe in, you know, which is not true sometimes. Then you find that this thing which is not true makes them not to understand why science happens the way it happens. From there you have to convince them so that they can understand what is the truth about science and what is not true about their indigenous knowledge (Mrs AN, Interview, 2013).

The Indigenous knowledge that Mrs AN can identify in connection with school science is in the form of community beliefs, for instance, about lightning[58]. Students' beliefs on lightning are not compatible with school science, and make it difficult for students to both understand and accept scientific principles. The teachers propose greater opportunities for dialogue with community Elders. They (teachers) are willing to liaise with Elders to find ways of negotiating knowledge spaces between local knowledge and school science. The teachers suggest integration that is facilitated through "coming together" (Mr PS); holding "discussions" (Mrs BM); and "linking" Indigenous knowledge and school science (Mrs AN). IK-science integration, in the teachers' view can be based on school-community knowledge conversations. The teachers commend the approach taken in this study (i.e. working with both the school and the community), and they think the study has presented an important example of that:

[58] Students' ideas on lightning represent a favourite IK-science research topic in South Africa (see Maduna, Masuku & Gundry, 2008; Moodie, & Ndlalane, (2008). Science Education Project, 1990; Setlhare Curriculum Trust, 1989).

> I learnt a lot when it comes to teaching Physical Sciences. The project helped a lot. It helped the learners to be able to do 'research' - to research from the Elders. Information is in the community. They don't always need to go far away to the libraries to get the information (Mrs AN, Interview, 2013).

The teachers' suggestions for integration highlight ways in which 'research attitude' has shaped participant response in this study. The teachers realise the benefit of school-community collaboration in the study and they propose it for shaping the local curriculum. This finding is similar to the proposal for "community-centred curriculum" made by Keane (2006a). This study thus presented a bridge between the school and the community, which will hopefully last beyond the study. The summary of findings in the form of a community booklet written in both isiZulu and English contributes to that lasting relationship.

The teachers' proposal for dialogue with the community does not occur in isolation. In the different meetings, the Elders also suggested greater involvement in sharing the knowledge they have with the school. For instance, female Elders expressed willingness to teach students the processes involved in making reed mats, from harvesting the reeds, drying them and the actual making of the mats. The Elders report going to the school every year to pray for Grade 12 students before the Senior Certificate examinations – a symbol of sharing beliefs and deep-seated spiritual values.

In response to the question of tangible benefits that the study would bring to the community, the School Governing Body and the Traditional Council agreed on the construction of a traditional hut being built in within school premises. The siting of the hut would serve as a permanent symbol for the bridging of indigenous and modern knowledge. However, in an unfortunate turn of events that cannot be detailed in this report because of the ethical implications, the hut construction did not materialise.

From the point of view of the participants, there is room for integration of local knowledge and modern knowledge, as represented by school science. The participants' suggestions on how such integration can be done points towards the importance of creating spaces for dialogue. In the next section, I examine the curriculum documents that guide teaching of Life Sciences and Physical Sciences.

7.5 Curriculum Documents

The national curriculum documents present the essential guidelines for any suggestions that could be made about IK-science integration. When I started this study, school-level teaching and learning was guided by the National Curriculum Statement (NCS), which was based on principles of Outcomes-Based Education (OBE). As a relatively new democracy, South Africa continues to review its policies relative to experience, challenges and national goals. The NCS was replaced by the Curriculum and Assessment Policy Statement (CAPS) which became effective in 2011. The CAPS documents represent a significant shift away from OBE, and are more prescriptive, giving week-by-week teaching plans for all subjects. Although this new development may be trying to solve problems related to teachers' lack of content knowledge, a major concern in South African schooling (Taylor, 2011), the CAPS requirements may constrain teacher creativity and response to local conditions.

In my attempt to find ways in which IK and school science could be integrated, I used only the CAPS Life Sciences and Physical Sciences subject statements, since they are the ones through which the Department of Basic Education articulates its position regarding IK and school science from 2011 going forward. I examined the specific aims and content of both subject statements and in addition, examined the general aims presented in the CAPS documents.

7.5.1 Organisation of the Life Sciences content

Content in the Life Sciences is organised around four "knowledge strands" which are developed progressively over the three year period of the FET (DBE, 2011a). The strands are:

- Life at the Molecular, Cellular and Tissue level
- Life processes in Plants and Animals
- Environmental Studies
- Diversity, Change and Continuity

It is expected in the Life Sciences curriculum that the topics within each strand as well as the knowledge strands themselves are not treated as separate or independent of each other (see Table 7.2 for details of concepts and content progression).

Indigenous knowledge systems are included under Specific Aim 3 of the Life Sciences subject statement: "appreciating and understanding the history, importance and

applications of Life Sciences in society" (DBE, 2011a, p. 16). The sub-aims under this Specific Aim are:

- Understanding the history and relevance of some scientific discoveries;
- Relationship of indigenous knowledge to Life Sciences;
- The value and application of Life Sciences knowledge in industry, in respect of career opportunities and in everyday life.

Table 7.2 Life Sciences concepts and content progression

STRANDS	**Life at the Molecular, Cellular and Tissue level**	**Life processes in Plants and Animals**	**Environmental Studies**	**Diversity, Change and Continuity**
Grade 10	Chemistry of Life: - Inorganic and - Organic compounds Cell – unit of life Cell division (mitosis) Plant and animal tissues	Support and transport systems in plants Support systems in animals Transport systems in mammals	Biodiversity and classification History of life and Earth	Biosphere to ecosystems
Grade 11		Energy transformations to support life: Photosynthesis Animal nutrition Energy transformation: Respiration Gas exchange Excretion	Biodiversity-classification of micro-organisms Biodiversity-plants Reproduction-plants Bio-diversity-animals	Population ecology Human impact on the environment: current crises
Grade 12	DNA code of life RNA and protein synthesis Meiosis	Reproduction in vertebrates Human reproduction Nervous system Senses Endocrine system Homeostasis	Darwinism and natural selection Human evolution	

(Department of Education, 2011a, p. 9)

The national curriculum planners encourage the use of indigenous knowledge examples in the Life Sciences, and emphasise that such examples "**will** also link directly to specific areas in the Life Sciences subject content" (DBE, 2011a, p. 16, emphasis in the original). The IK shared in Mqatsheni relates mainly with the Life processes in Plants and Animals, and Environmental Studies knowledge strands. There seems to be a mismatch between IK present in Mqatsheni and the demands of the Life Sciences

subject statement, in that the curriculum planners expect **examples** of knowledge that relate with school science content, when factual forms of IK are not emphasised in Mqatsheni. There is greater emphasis on values. The foregrounding of values and not factual knowledge could have been a result the influence of my methodology. However, there were ample opportunities for participants to talk about factual knowledge, and they chose not to.

The knowledge revealed in Mqatsheni suggests two prerequisites for successful IK-science integration. Firstly, curriculum planners and teachers need to understand the nature of Indigenous knowledge in as much as they understand the nature of science (Ogunniyi, 2007). This would inform the appropriate ways of integrating IK with science. Secondly, there is need for greater consultation with communities to understand their curriculum needs and hopes.

7.5.2 Organisation of the Physical Sciences content

Indigenous knowledge is not mentioned in the specific aims of Physical Sciences, but IK could possibly be drawn on in relation to the first and second specific aims (underlined):

> The purpose of Physical Sciences is to <u>make learners aware of their environment</u> and to equip learners with investigating skills relating to physical and chemical phenomena, for example, lightning and solubility
>
> Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving; the construction and application of scientific and technological knowledge; an <u>understanding of the nature of science and its relationships to technology, society and the environment.</u>
>
> (DBE, 2011b, p. 8, my own emphasis)

The content in Physical Sciences is organised around six knowledge areas:

- Matter and Materials
- Chemical Systems
- Chemical Change
- Mechanics
- Waves, Sound and Light
- Electricity and Magnetism

The specific content to be taught in each grade is shown in Table 7.3.

Table 7.3: Physical Sciences overview of topics

Topic	Content	
Mechanics	Grade 10	**Introduction to vectors & scalars; Motion in one dimension; Energy**
	Grade 11	**Motion in two dimensions; Newton's Laws and application of Newton's Laws**
	Grade 12	**Momentum and impulse; Vertical projectile motion in one dimension (1D); Work, Energy & Power.**
Waves, Sound & Light	Grade 10	**Transverse pulses on a string or spring; Transverse waves; Longitudinal waves; Sound; Electromagnetic radiation.**
	Grade 11	**Geometrical optics; 2D and 3D Wave fronts**
	Grade 12	**Doppler effect (either moving source or moving observer)**
Electricity & Magnetism	Grade 10	**Magnetism; Electrostatics** (attraction between charged and uncharged objects, charge conservation, charge quantization); **Electric circuits** (emf, potential difference, current, measurement of voltage and current, resistance, resistors in parallel).
	Grade 11	**Electrostatics** (Coulomb's Law, electric field); **Electromagnetism**; **Electric circuits** (energy, power).
	Grade 12	**Electric circuits** (internal resistance and series-parallel networks); **Electrodynamics.**
Matter & Materials	Grade 10	**Revise matter and classification** (materials, heterogeneous and homogenous mixtures, pure substances, names and formulas, metals and non-metals, electrical and thermal conductors, insulators, magnetic and non-magnetic materials); **States of matter and the kinetic molecular theory; Atomic structure; Periodic table; Chemical bonding; Particles substances are made of.**
	Grade 11	**Molecular structure; Intermolecular forces; Ideal gases.**
	Grade 12	**Optical phenomena and properties of materials; Organic chemistry; Organic macromolecules.**
Chemical Systems	Grade 10	**Hydrosphere**
	Grade 11	**Lithosphere**
	Grade 12	**Chemical industry**
Chemical Change	Grade 10	**Physical and chemical change; Representing chemical change; Reactions in aqueous solutions; Stoichiometry** (mole concept).
	Grade 11	**Stoichiometry** (molar volume of gases, concentration, limiting reagents, volume relationships in gaseous reactions); **Energy and chemical change; Types of reactions.**
	Grade 12	**Reaction rate; Chemical equilibrium; Acids and bases; Electrochemical reactions.**

(Department of Basic Education, 2011b, p. 10,11)

The few examples of science-like IK could relate to Matter and materials (e.g. the construction of traditional Zulu huts that could be used in teaching thermal conductors and insulators) and Waves Sound and Light (e.g. song and dance which involves the beating of drums). There is little knowledge that was shared in Mqatsheni that lends itself directly to explanations using science concepts.

7.5.3 Statement of aims

As the data began to show how inadequate and inappropriate it was to think of IK-science integration in Mqatsheni only in terms content, I decided to look at curriculum aims, in order to explore possible forms of integration that would suit the nature of knowledge in Mqatsheni. I therefore turned to the aims of the CAPS documents. The Curriculum and Assessment Policy Statement aims to produce learners who are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively as individuals and with others as members of a team;
- organise and manage themselves and their activities responsibly and effectively;
- collect, analyse, organise and critically evaluate information;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.
  (Department of Basic Education, 2011a: 3)

I analysed the aims of the curriculum in relation to the knowledge and worldview of the students in Mqatsheni, to identify areas where they (IK and worldview) could enhance the achievement of these aims, and where they could present challenges.

7.5.3 1 IK and worldview as enriching

The students' orientation towards relationships may make it easier for them to *work with others as members of a team*[59]*.* The richness of their knowledge of isiZulu and the importance of games, poetry and song in the community could be used to assist students to *communicate effectively using visual, symbolic and/or language skills in various modes,* but only if their home language is given space in the science classroom. Language could also assist students in *collecting information* especially that which can be gathered from speakers of isiZulu. In view of their orientation towards *ubuntu* and respectful relationships with both people and nature, the students are also likely to *use science and technology effectively* (but not necessarily critically), *showing responsibility towards the environment and the health of others.* Because of their understanding of nature as interconnected, they are likely to *demonstrate* (probably with ease) *an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation*.

[59] The phrases in italics are taken from the aims of schooling as given in the CAPS documents listed on pages 9 and 10.

7.5.3.2 IK and worldview as presenting challenges

Students' upbringing is in a context where respectful relationships are defined in terms of silently carrying out of instructions; speaking only when invited to, and where expressing their own opinions was not encouraged (see Khupe, Keane & Cameron, 2012). It is likely then, that students in Mqatsheni might struggle in situations requiring *making decisions using critical and creative thinking*. Because of their worldview orientation towards seeing interconnections between phenomena, the students may find it difficult to *analyse* and *organise information*, and worse still to *critically evaluate* information. Their orientation towards sharing responsibilities may discourage *effective individual work*. Therefore, some aspects of learner worldviews may present challenges against the achievement of curriculum aims, and as indicated by the teachers, indigenous knowledge and beliefs contribute to difficulties in understanding science content.

From the above observations, the question of <u>what</u> IK in Mqatsheni could be integrated with science does not have a simple answer because:

- little IK in Mqatsheni lends itself to science explanations (DBE, 2011b), and the content in the curriculum documents make no reference to IK;
- although reference to IK in the Life Sciences specific aims is more explicit, IK is not mentioned in the Physical Sciences aims; and,
- community suggestions on what knowledge to include in school science centre around values and practical skills, hence it is inappropriate to think of integration only in terms content.

However, community values can be drawn on to improve students' engagement with science teaching and learning. Opportunities for IK-science integration in Mqatsheni seem to lie beyond science content – and curriculum materials on IK tend to focus on content (e.g. Ogunniyi, Kwofie, Mushayikwa, & Amosun, 2011; Science Education Project, 1989). A focus on curriculum aims could open up spaces for integration by shifting focus from science content to *ways of working with the content*.

7.6 Discussion

The question that was central to my study was *<u>what</u> aspects of the participants' knowledge could be included in school science and <u>how?</u>* The guiding research questions give rise to further questions: Should integration be based on only those

aspects of Indigenous Knowledge that look like science or should it include everything that makes up Indigenous knowledge? How can the integration be done in a context where science is taught largely by 'chalk and talk', and IK by lived experience? In the context of Mqatsheni, all the forms of knowledge shared by the community could be used in school science, viz: values; knowledge of place; cultural practices; practical skills, and the worldview underpinning them.

7.6.1 Which IK for school science?

All the groups of participants had suggestions about what IK could be included in the curriculum. The students wanted to learn more about the environment, the history of Mqatsheni and practical skills. Elders wanted children to learn values and practical skills. Teachers wanted indigenous beliefs to be discussed in the classroom to address the differences between these beliefs and school science. The situation in Mqatsheni is different from reports from other contexts where teachers have been reported to be reluctant to integrate IK and science (e.g. Moyo, 2011). That the teachers did not introduce discussions on indigenous beliefs in the classroom before this study is an indication of how important this study has been in terms of influencing views towards IK and science integration. As a consequence of the study, the people of Mqatsheni want all aspects of IK to be taught in the classroom. This is because this knowledge and accompanying beliefs and views of reality, all influence students' learning, particularly science learning. An all-inclusive approach to the integration of IK and school science gives space for four important themes in Indigenous knowledge, namely: Elders; language; culture and experiential learning (Sutherland & Henning, 2009; Sutherland & Swayze, 2012). Sutherland and Henning (2009) describe these themes as "pillars" supporting lifelong indigenous science education. Besides, IK is not compartmentalised, hence it would be inappropriate to include only aspects of it.

Values (a part of culture) have always been taught in science, whether explicitly or implicitly (Hildebrand, 2007), although it is usually the values of the planners that are reflected in the curriculum documents. The South African curriculum is built on the values that inspired the Constitution, and hence is based on the principles of (among others): social transformation; active and critical learning; human rights, inclusivity, environmental and social justice; and valuing indigenous knowledge systems (DBE, 2011b, p.4, 5). An important finding of this study is the valuing of Indigenous knowledge *systems* rather than only the IK that relates to science. This means IK-science integration that is based on identifying science-like examples constitutes a surface approach and may not achieve the purposes for which integration is intended.

Including the values that underpin knowledge in Mqatsheni in science teaching and learning is consistent with both trends in science education that acknowledge the need to address multiculturalism, and with the purposes of the South African curriculum. 'Multiculturalism' in the Mqatsheni context means valuing the knowledge and changing culture of this particular community of Zulu people, and not just the Western way of knowing typical of school science. The community in Mqatsheni could be described as homogenous, and would thus not fit the usual application of multicultural science education where indigenous (or other non-Western) populations are in the minority (e.g. Richards, Conlin, Gupta & Elby, 2012). Drawing on the students' sociocultural background serves to make connections that would help maintain links with their own culture, and to enable greater epistemological access to science knowledge. Specific values that could be included in the context of Mqatsheni would particularly focus on respect for both people and the environment; a sense of community; awareness of the local environment; and the strong relationship between the social, the physical and the spiritual.

Cultural value systems, beliefs and practices can negatively affect student learning (Cameron, 2007; Cobern, 1996; Keane, 2006; Lemke, 2001), but could be used in the classroom in such a way that students are not disadvantaged (Aikenhead, 2001). I find Richards, Conlin, Gupta and Elby's (2012) proposition relevant for the Mqatsheni context: "for some students, the strongest connections to science can be found not through their identifying with a particular topic, but with a particular way of approaching knowledge and learning in science, i.e. a particular epistemological stance" (p. 334). Focusing on students' cultural values and ways of understanding shifts IK-science integration away from content to ways of teaching and learning that the students can better relate to. Such a shift has the potential to check the disenfranchisement of learners whose value systems have not been prioritised in science education (Hildebrand, 2007; Odora Hoppers, 2002a).

The Elders and students in Mqatsheni celebrated their culture and expressed willingness to learn more about Indigenous knowledge as much as they wanted to learn more about science. This finding differs from the mixed responses in Webb's (2013) study among Xhosas where some participants argued for the inclusion of IK while others argued against it. Although all the participants in Webb's study were Xhosa speaking, they came from different communities, including urban areas, and that could have influenced their views on Indigenous knowledge. Some scholars have vehemently

argued against the integration of Indigenous knowledge in learning, citing a certain study where Indigenous children had rejected beadwork as “foreign and old-fashioned, a practice that only their grandparents indulged in” (Horsthemke & Schafer, 2007, p. 5). Horsthemke & Schafer (2007) did not specify the context in which the quoted sentiments were raised, but even if they had, the claim would not necessarily apply across contexts.

Knowledge in Mqatsheni includes a strong sense of belonging to place, expressed through knowing the history of the land, and a strong sense of identity that is conveyed through language. This is not an unusual finding so far as studies in IK across the globe are concerned. The importance of ‘place’ and language for indigenous peoples is discussed in the literature as supporting life-long learning (Aikenhead & Michell, 2011; Sutherland & Henning, 2009), and as important for strengthening identity (Keane, 2006). Foregrounding ‘place’ in IK-science teaching and learning results from an understanding of the situated nature of cultural experiences; hence suggestions for the development of curricula and curricula frameworks that acknowledge the priorities of indigenous peoples (Aikenhead, 2001; Keane, 2006; Sutherland & Henning, 2009).

In this study, I argue for considering all aspects of the indigenous knowledge in Mqatsheni for teaching and learning. This all-inclusive stance on IKS in teaching and learning is not common among South African studies. Previous studies have usually focused on singular aspects of IK, although the studies have significantly contributed to our understanding the diversity of Indigenous knowledge. Examples of these include indigenous games (Moji & Hattingh, 2008; Mosimege, 2003; Roux, 2007); indigenous technology (Maluleka, Wilkinson & Gumbo, 2006); plants and plant healing (Hewson, Javu & Holtman, 2009) as well as food plants (Shava, 2000).

7.6.2 How IK and school science could be integrated

The people of Mqatsheni make suggestions on how local knowledge may be integrated into school knowledge. The Elders suggest a hands-on approach in addition to the “paper knowledge” (Mrs Majozi, October 2010) that the students learn at school. The teachers suggest greater dialogue between the school and the community for the purposes of sharing knowledge with Elders. The Elders are willing to share the knowledge and skills that they hold with the children in school. The students express interest in learning through games, interviewing Elders and other outdoor activities done during the study, and suggest they be incorporated in school subjects.

The willingness of the school and community to share knowledge is a significant finding not only in this study, but in other South African studies as well. Hewson, Javu & Holtman (2009) report similar findings in their study on traditional healing. However, a participating teacher in Keane's (2006) study was not comfortable having a traditional healer engage with students at classroom level. It should be noted however that Keane's study was looking at 'relevant science' generally and had not elicited an extensive input on IK, and might be one example of teacher reluctance seen in some of South African studies (e.g. Moyo, 2011). It is possible the emphasis on dialogue exemplified in this study might have influenced the attitude of the teachers.

Dialogue between school and community as a means of integrating IK and school science has been suggested in the literature (e.g. Aikenhead, 2001; Malcolm, Sutherland & Keane, 2008). These studies emphasise the involvement of Elders (as community knowledge bearers) in developing of a framework for 'long-term science education' among First Nations people in Manitoba (Sutherland and Henning, 2009), as well as in the *Rekindling Traditions* among the Cree in Saskatchewan, also in Canada (Aikenhead, 2001). In situations where both the teachers and Elders are willing to negotiate knowledge spaces – as is the case in Mqatsheni, dialogue between the school and community extends space for cultural brokering beyond the classroom, to the community. Both the teachers and the Elders can participate in becoming Aikenhead's (2001a; 1996) 'cultural guides', assisting students to understand the nature of scientific knowledge and the nature of indigenous knowledge.

However, dialogue between school and community; teachers and students, and even amongst students can only succeed where there is tolerance and respect for difference in opinion. Respect in Mqatsheni is conceived of more in terms of hierarchy and obedience. Conceptions of respect among both Elders and students in Mqatsheni suggest unequal valuing of opinion because of gender and/or age and may thus be a hindrance to full participation in science learning (Khupe, Keane & Cameron, 2012). This may hinder the application of dialogic strategies (for instance, discussion and argumentation) in science learning, which have been shown to be valuable for science learning in some South African contexts (Msimanga & Lelliott, 2013). The use of argumentation as a way of engaging Indigenous knowledge and school science has also been used by Hewson & Ogunniyi, 2011; Ogunniyi, 2007a; 2007b; Webb, 2013) and recommended as a valuable strategy of engaging IK and school science. In Mqatsheni, argumentation would need to be preceded by negotiating cultural practices

and values that would otherwise discourage classroom talk. Slaton & Barton (2012), for example, suggest teaching that emphasises respectful relationships through engaging students in conversations that elicit their experiences and stories, and accepting and valuing all students' responses.

Students in this study appreciated activities that took them out of the classroom, as well as the ones that accorded them interaction with Elders. The Physical Sciences teacher said that she had learnt from this study that there was knowledge in the community, hence students "do not always need to have a library". The teacher's participation in the study might have taught her about creative pedagogies, as suggested in Malcolm, Sutherland & Keane (2008). The use of games, stories, field work and other outdoor activities in Mqatsheni can allow students to both enjoy the beauty of the natural environment and to continually see the connections between segments of science content when viewed from the natural environment. Science teaching and learning in Mqatsheni demands recognition of students' learning preferences and learning strengths based on their worldviews. For instance, participating students pursue work for communal good rather than their individual purposes. Teaching and learning that involves group tasks and shared responsibility may resonate more with their way of relating than tasks based on individual competition. Yet of course, many class tasks as well as class assessment and progression is individual, therefore teachers have to find creative ways of encouraging individual work.

In Table 7.4, I make suggestions of possible ways in which science teaching and learning could benefit from the knowledge that was shared in Mqatsheni.

Table 7.4: Application of local knowledge in science teaching and learning

Knowledge and worldview	**Possibility of application**
Values	• practical environmental conservation activities based on the value of respect • Encouraging respectful learner-teacher and learner-learner dialogue in the classroom. • Encouraging deliberative argumentation on issues • Using project work where students consult with Elders and/or study phenomena in the local environment. • Invite Elders as resource persons to facilitate discussions on issues where they have expert knowledge.
Language	• Promoting classroom dialogue through the use of students' home language. • Encouraging students to explain or summarise concepts learnt in home language.
Traditional foods	• Using locally found and valued examples as basis for teaching and learning in *Chemical Systems* and *Chemical Change*
Spiritual connections	• Using role-plays that include roles for ancestral spirits in for example, environmental protection.
Knowledge of the environment	• Incorporating fieldwork in Environmental Studies; Life processes in Plants and Animals; Diversity, Change and Continuity. • Using locally available plants and animals to explain concepts in the knowledge strands listed above. • Teaing science through the issues-based approach •
Song and Dance (*ingoma*) and Poetry	• Having students express their understanding of topics / concepts in the form of poems. The poems could reflect the extent to which students can link concepts in the same ways as would do concept maps and/or mind maps, and also as an avenue to understanding students' feelings and attitude towards their topic learnt. • Using song and dance in teaching Waves, Sound & Light.
Hut construction	• Investigating issues about thermal conduction in Matter and Materials.
Aesthetics	• Increasing the number of outdoor activities. • Including questions on aesthetics in regular assessment.

IK-science integration in a context such as Mqatsheni needs the support of teacher professional development programmes that are based on critical and creative methodologies – methodologies that encourage teacher participation and collaboration, and those that would involve trialling out possibilities for integration of IK with school

science. Lessons can be drawn from Chinn (2007), whose study revealed the potential of creative methodologies in encouraging science teaching that acknowledge student contexts and prior knowledge.

When reflecting back on the findings from this study, the following questions arise: Who or what is the current curriculum serving? Should communities have a choice of curriculum? My opinion is that the present curriculum does have potential to serve students in different communities, but that potential could be more apparent when it gives greater space for response to local contexts. In its current form, the curriculum seems to be 'one-size-fits-all', and as a result, better serves non-rural contexts, and those contexts that are better-resourced for the teaching and learning of WMS. Because of the plurality of cultural contexts in South Africa, I argue for space for community input, and for the consideration of local worldviews in the teaching and learning of science.

7.7 Conclusion

Although much of the IK and worldview in Mqatsheni does not lend itself to being adapted for the prescribed content areas of either Physical Sciences or Life Sciences, there is room for the use of Indigenous knowledge *systems* in Mqatsheni to achieve the principles and purposes of the national curricula. Participants' recommendations on what to include in school learning suggests that all forms of IK found in Mqatsheni must be considered for science teaching and learning. The knowledge, beliefs, cultural experiences, and talents that the students have influence their engagement with science knowledge, and hence these need to be recognised. The teachers and Elders of Mqatsheni agree on the importance of creating spaces for dialogue that could enhance cultural brokering from both school and home. IK-science integration as proposed here is not likely to disadvantage students in contexts such as Mqatsheni, because the same subject content as in other contexts will be taught. However, the students will be afforded the opportunity to learn the content in ways that acknowledge their knowledge, their worldviews and their experiences. Such integration has potential to enable students in Mqatsheni to compete with learners from different contexts.

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I want to continue with this project because it gives me motivation and encouragement about my future (Student participant, 2011).

8.1 Introduction

The purpose of this interpretive study was to explore and document the Indigenous knowledge and worldview held by the people of Mqatsheni rural community in KwaZulu-Natal, with a view to creating opportunities for this knowledge to be available for use in school science at the Further Education and Training Phase (FET). This intention is in keeping with the principles of the South African curriculum documents that call for the valuing of Indigenous Knowledge Systems. However, the science subject statements make little reference to IK, thus leaving it to the teachers to decide on what IK to include in science teaching and learning, and how.

The questions that guided this study were:

1. What Indigenous knowledge can be identified from interaction with participants in Mqatsheni?
2. What constitutes the worldview that informs the community's Indigenous knowledge?
3. What aspects of the participants' knowledge could be included in school science, and how?

With guidance from the writings of Indigenous scholars (e.g. Battiste, 2005; Louis, 2007; Smith, 1999; Wilson, 2001), and my own experience of growing up and working in rural communities, I understood two factors as prerequisite to getting meaningful answers to my research questions. Firstly, I needed to clearly understand the context of the study. Secondly, the study had to proceed on the basis of active community involvement in the construction of the knowledge. I therefore made the building of relationships through collaborative research a priority from the beginning of this study, in keeping with the principles of indigenous methodologies (Louis, 2007), and transformative participatory research (Malcolm *et al.,* 2009). The resultant research partnership with community Elders, high school students and teachers lasted two years, during which time each group of participants engaged in a variety of activities that allowed for collective exploration of aspects of IK and worldview (Malcolm, Gopal, Keane et al, 2009; Mertens, Sullivan & Stace, 2013).

A number of issues emerged from these activities that did not appear to directly address the research questions. These issues are an important emergent part of the study and have needed to be included in this report in keeping with the participatory process. The issues illuminate the contemporary context and the concerns that the community is facing, and as such touch on both IK and worldview concerns. These concerns directly relate to the school curriculum and the role that this curriculum is intended to play in developing the citizens of South Africa. The Elders are worried about the lack of employment for youth and the prevalence of HIV/AIDS. Teachers are concerned about teenage pregnancies. The youth are worried about the many orphans and vulnerable children in the community.

Science Education as a whole has the obligation to address issues such as these, particularly when they occur in a province that is home to 31.9% of the total population affected by HIV/AIDS in the country (Statistics SA, 2013). There are many causes of the issues revealed through this study, particularly when in the national context pregnancies inadvertently offer a source of income through government-sponsored child grants for unemployed mothers. More specifically, in terms of this research study, what can Science Education in association with IK offer to prepare learners for the world in which they find themselves and in a society in which belief in 'virgin cleansing'[60] could be a contributing factor to the rape of young girls (Leclerc-Madlala, 2002). The belief and practice of virgin cleansing could be contributing to high HIV infection rates and to

[60] There is widespread belief that having sex with a virgin girl is a cure for AIDS.

teenage pregnancies, both of which have been long-term scourges in South African society. Science education must not turn a blind eye to the issues raised by the community of Mqatsheni through this study. Local level curriculum design could draw on Hodson's (2010, p. 197) calls to "social critique, values clarification, and socio-political action".

Students who participated in this study had chosen to take science in their studies towards a school-leaving certificate. The students' subject choices were limited to two routes: sciences and commercials. If they were in a different context, their choices would have been determined by (among other things) the variety of available options as well as their perceived value to the students. The students' interest for science could have influenced some findings, for instance what they preferred to learn more about, but as seen in chapter 6, their interest in science hardly had any influence on their view of reality.

In the following sections I specifically answer the research questions.

8.2 What Indigenous Knowledge Can Be Identified From Interaction With Participants In Mqatsheni?

Knowledge that is valued in Mqatsheni includes values, practical skills, connections to the land, cultural practices and the Zulu language. IsiZulu is the vehicle for the inter-generational transmission of local knowledge, and gives specific identity to all those knowledge forms. In this context, isiZulu would be appropriate for science teaching and learning as well as for sharing Indigenous knowledge. As argued by Msimanga and Lelliott (2013), "engagement in the learners' languages does not necessarily lead to poorer or less formal forms of engagement that deny access to science content" (p. 22). However, in the broader community context, isiZulu gives way to English as soon as one leaves Mqatsheni. Employment even in places as near as Underberg (only 30km away) requires knowledge of English. Therefore, although the rewards of the use of learners' home languages in learning are clearly documented (McKinley, 2005; Rollnick & Rutherford, 1996), the reality of the world outside Mqatsheni requires balancing the importance of isiZulu and English, rather than replacing one by the other.

While searching for knowledge domains, I repeatedly found a focus on axiology rather than epistemology. When bringing questions about IK to discussions, community

members continually emphasised values, particularly respect, honesty, gratitude, caring and collective responsibility. However, changes in the socio-political sphere have resulted in a disjuncture between some cultural values and those values upheld in a democracy. As a result, the younger generation is beginning to question traditions that limit their sense of independence and choice, such as observing certain taboos and participating in virginity tests.

8.3. What Constitutes the Worldview That Informs the Community's Indigenous Knowledge?

The people of Mqatsheni express a strong sense of identity, belonging and a collective sense of being. They think of the individual in the context of relationships with fellow human beings in both natural and spiritual realms. Collective co-existence e.g. "indawo yethu" (*our* place) and "endaweni yakithi" (in *our* place) are recurring phrases. The people express a closeness to and dependency on nature for sustenance. The Elders celebrate the beauty of Mqatsheni, peace and collective co-existence. Students express gratitude, appreciation of the beauty of, interconnectedness and interdependence between the social, natural and spiritual worlds. The spirits of the ancestors have a special place in the people of Mqatsheni. The ancestral spirits are believed to dwell among the people, and to partake in family affairs such as marriages and initiation rites. They are believed to dwell in traditional Zulu huts. None of the participants mention the ancestral spirits in relation to learning. However, if we consider the closeness of the Africans with their religion as described by Mbiti (1969), and findings from Cameron's (2007) study, it is very likely that the students bring recognition of the role of ancestral spirits to the classroom, and that this forms part of the students' thinking and learning. This way of understanding the world constitutes the worldview of the people of Mqatsheni.

Science teaching and learning does not emphasise these values. The teachers say that they value the 'team spirit' prevailing at their school, and they are prepared to work with the community to better understand indigenous beliefs. The social relationships in Mqatsheni are governed by the ideals of ubuntu, expressed through caring for one another, and through respect. The escalating violence against women and children indicates a negative effect of the breakdown of values, and a threat to *ubuntu*. Can science education in Mqatsheni play a role in strengthening and restoring *ubuntu*? Is

there possibility for science education based on relationships? What would such a curriculum look like?

In contexts like Mqatsheni, science education could integrate the local emphasis on relationships with ideas from the perspective of relational thinking (borrowed from economics), and highlight the place of human relationships alongside measurable learning outcomes (Schluter, 2013; Schluter & Lee, 2009). In relational thinking, relationships are a key ingredient towards social transformation, a perspective that is consonant with the indigenous paradigm (Louis, 2007; Mutua & Swadener, 2004; Vakalahi & Taiapa, 2013). Science education in Mqatsheni would thus need to encourage respectful coexistence of different ways of knowing.

8.4 What Aspects of the Participants' Knowledge Could Be Included In School Science, and How?

8.4.1 Knowledge for school science

Participants understand knowledge in their context as comprising (among other things) raising crops and livestock, sharing knowledge on health, traditional medicine, art and craft, religious leadership, community representation, history of the local area; knowledge of the local environment and knowledge of language. While some of the knowledge can be related to the content of school science (for example knowledge related to farming), other forms of the knowledge (for instance religious beliefs and community leadership) are more difficult to fit in with school science. Nonetheless, the community values them, and students bring them to the science class. While the traditional science class would dismiss such knowledge as belief and superstition (see Horsthemke, 2004), the importance of giving recognition to socio-cultural factors in science learning is now widely accepted (Aikenhead, 1996; Bang & Medin, 2010).

The data gathered through this study was not from direct questions about the forms knowledge held in the community. Rather, I left it to the participants to offer knowledge that was important for them (as explained in Chapter 5). In Mqatsheni, the value of knowledge is determined by its relevance to the needs of the community. The absence of responses relating to professional qualifications and political prominence, for instance, raises questions about their relative value compared the desire to share with, and to empower fellow human beings, as in the example:

[uNdlovu] ufisa ukuthi wonke umuntu azibone ewumuntu (Lindisiwe, MKP, 2011).

{Mr Ndlovu desires to see everyone value themselves}.

This study reveals that what participants in Mqatsheni choose to highlight as knowledge is a statement of what they value. Both the knowledge that easily fits with school science content and that which does not, is valuable to the participants. Science teaching and learning in this context may need to acknowledge the various forms of knowledge mentioned in this study, in keeping with culturally relevant pedagogy (Ladson-Billings, 1995a; 1995b).

If the integration of IK and school science only has room for Indigenous knowledge that fits with science content, then only a fraction of the knowledge in Mqatsheni will be available for integration, and that fraction would not be a true reflection of the entirety of the knowledge in the community. The resultant 'integrated' curriculum would simply take the current form of school science, and punctuate it with a few examples of IK. This would represent a watered down version of the knowledge and values of the community and in a sense would inadvertently degrade the fullness of the knowledge and the worldview that the curriculum is trying to acknowledge and celebrate. The *valuing* of Indigenous Knowledge Systems that is proposed in the South African curriculum documents can only be achieved when curricula take indigenous knowledge for what it is – more than *factual* knowledge, but extending into *performative* and *ontological* knowledge as explained by Keane (2008). These three components are interconnected in a context such as Mqatsheni. Therefore, Indigenous knowledge as found in Mqatsheni is systemic, emphasising relationships and interconnectedness. Integration efforts that recognise local knowledge as a *system* will have taken a step towards *valuing* it.

South African society has a dark past that the democratic government is trying to redress through educational reform. The reforms have sought to widen knowledge boundaries to include formerly excluded local knowledge systems, and also to be able to offer opportunities for higher education and employment to its formerly disadvantaged population groups. Unfortunately, schooling is not achieving these national goals for the students in Mqatsheni. Academic achievement is low, and there are high dropout rates throughout the schooling years. The South African Department of Basic Education has not yet found a formula to balance ideal and reality for underprivileged communities like Mqatsheni.

This study has left me wondering whether the current curriculum is effectively serving the whole nation, and whether it is offering communities what they actually desire for their children. If not, who is it that the curriculum is serving? Should there be room for communities to make choices of curriculum content and method? If so, what would the resultant curriculum look like?

As a result of this study, the people of Mqatsheni were brought to a place of expressing their desire to be involved in the curriculum. They made suggestions about what IK to include in the curriculum. The students indicated that they wanted to learn more about the environment, the history of Mqatsheni and practical skills (which falls under *knowledge of place* and *practical skills* as described in chapter 6). Elders want the children to learn about respect[61] (*values*) and *practical skills*, especially farming. I found it significant that the Elders are willing to entrust the teaching of traditional values to the school. Could it be that the Elders can no longer teach these values themselves, and/or could it be a vote of confidence in the school's potential to supplement family efforts in teaching them? The majority of teachers at the participating school come from neighbouring communities and could possibly be trusted with teaching Mqatsheni community values. Teachers would like students' indigenous beliefs to be discussed in the classroom. They (teachers) indicated that they often dealt with cases of students' knowledge conflicting with science knowledge, which then poses a barrier to their understanding of school science. As far back as 1990, the Science Education Project observed this about children in Umlazi (also in KwaZulu-Natal Province):

> Children are very interested in lightning; they may fear lightning and most of them have strong ideas about it. So it would be strange if we did not help them to think about lightning in science lessons (Science Education Project, 1990, p. 3).

In the context of Mqatsheni, it would be strange for school science not to be inclusive of issues of relevance and interest to the community. As a result of this study, the teachers have shown that they would like their students to think about their beliefs during science classes. While I cannot say with certainty whether this interest to show recognition of students' cultural background and knowledge will continue after this study, I am encouraged that the study created possibilities for school-community interaction.

The curriculum suggestions made by the participants in this study point to a preference for the recognition of IK in its entirety. Such an all-inclusive approach could support

[61] Respect in Mqatsheni is understood in terms of respect for self; respect for others, and respect for the environment (Khupe, Keane & Cameron, 2012).

lifelong learning of science among in Mqatsheni, as suggested by Sutherland and Henning (2009). The values of respect for both people and the environment; a sense of community; awareness of the local environment; and the strong relationship between the social, the physical and the spiritual are of particular importance among the participants. The inclusion of such values in science teaching and learning would be consistent with what the people want, and would be in line with the recommendations of those who advocate for culturally relevant pedagogy (Ladson-Billings, 1995a; 1995b). This would also be consistent with the purposes of the South African curriculum. Focusing on values and local ways of understanding rather on than specific content, shifts IK-science integration away from isolated examples that look like science. Such a shift is consistent with the values of the community, and thus with the goal of valuing of Indigenous Knowledge Systems. Teaching that does not only focus on the subject matter but also on what students know and how they learn is more consistent with learner centredness (Malcolm & Keane, 2001). When teachers develop interest in how students learn, they inevitably begin to think more about *how* they teach. In contexts like Mqatsheni, where IK systems influence how students learn, teachers could begin to think about how the knowledge and values associated with IK can be integrated into the curriculum for the benefit of the students.

8.4.2 How integration could be done

In this study, the people of Mqatsheni do not only suggest local knowledge for learning at school. They also make suggestions that point to methods of teaching and learning for an integrated IK-science curriculum. The Elders suggest that learning through 'hands-on' approaches, and an orientation towards respect will strengthen the "paper knowledge" that students currently learn at school. The teachers suggest there be dialogue between the school and the community. Students would like to learn from the local environment and suggest more outdoor activities, an approach that they experienced and enjoyed doing during the research study. This study created a rare opportunity for parents and students to voice their thoughts about teaching and learning. Although theirs is not 'expert' opinion in the sense of curriculum theory, their suggestions are a result of lived experience, good understanding of prevailing needs and a desire for education that serves a purpose within the community. I argue that curriculum suggestions from communities such as Mqatsheni can be a legitimate resource for developing relationally-driven curricula (Bang & Medin, 2010), which can make a huge contribution to relevance and cultural responsiveness (Ladson-Billings, 1995; Malcolm & Keane, 2001).

Keane (2005) voices concerns about the political, economic and global isolation of rural communities despite the fact that those communities are home to more than half the South African population. Science education that places communities at the centre of the curriculum would not only reconnect rural communities to the rest of the nation, but could contribute to creative, long-term solutions to the spread of HIV/AIDS, teenage pregnancies and unemployment, through emphasis on respect for self and for others as well as emphasis on practical skills. If suggestions from Mqatsheni could be incorporated into everyday teaching and learning, the same content outlined in the curriculum documents would be taught, but the way in which it is taught would be meant to address the challenges faced in the community.

What emerged from this study were community requests for a community–based curriculum, culturally relevant pedagogy and learner-centred teaching and learning - all of which are within current trends in science education. The community want school science to be related to the local environment; to involve greater school-community interaction; and to be based on collaborative and respectful science teaching and learning. These ideas would need to be corroborated by further study, particularly through school-community collaborations in the design and trial of appropriate and relevant curriculum materials.

8.5 Implications

The findings of this study have important implications for Mqatsheni; for curriculum development and teacher professional development in the Department of Basic Education; as well as for future research in the role of Indigenous knowledge in science curricula. I discuss these implications in the following paragraphs.

8.5. 1 Mqatsheni

There are great possibilities for IK-science education in Mqatsheni. However, the evolving social context presents dilemmas about how to appropriately and respectfully recognise IK, while at the same time taking care not to promote unethical patriarchal tendencies in the science classroom. Promoting dialogue among learners and between teachers and learners could be one way in which respectful relationships could be developed. Msimanga and Lelliott (2013) observed how learner-learner questioning established rapport among group members in a way that the authors attribute to *ubuntu.* Similar strategies can be adopted in in Mqatsheni, especially if teachers deliberately

provide appropriate guidance (as exemplified in Slaton & Barton, 2012) to promote respectful interactions in the classroom.

The students are interested in learning science, and that is why they chose to pursue it at FET level. Science education in Mqatsheni needs to acknowledge that interest in the light of the students' knowledge and worldview. That way, science teaching would encourage them to construct their own learning using local worldviews and experiences as a foundation.

The Elders in Mqatsheni are keen for their children to learn farming skills. Subsistence agriculture in Mqatsheni is practised by only a few families and is limited to small patches of land. Full-scale farming now only abides in the Elders' memory. That the Elders want their children to learn farming skills is an attempt at reviving the practice that is said to have once provided food and income. The school offers Agricultural Science as one of the learning areas at the FET Phase, but the subject is not designed to equip students with practical farming skills but with laboratory knowledge of topics such as soil science. Through their participation in this study, the Elders see what the school could offer in contributing towards a long-term strategy to curb poverty and youth unemployment – both of which contribute to crime. The noble purpose of the national Department of Education of "providing access to higher education" (DBE, 2011a:4) is hardly being achieved in Mqatsheni. The Elders, through this study, are proposing a worthwhile alternative, but they need the backing of the Department of Education for the proposals to be implemented.

This study opened up spaces for community input and for the voices of children to be 'heard' in matters concerning education. One student said, "I want to continue with this project because it gives me hope and encouragement about my future". I cannot say whether such hope will continue for this student or for the community, beyond this study, but it is encouraging that the study gave birth to hope in the life of one child. Hopefully the school is now the "haven of hope, friendships and learning" (Malcolm, 2008:143).

8.5.2 The Department of Basic Education

This study has highlighted the power of collaborative knowledge construction involving students, Elders and teachers. The study has shown that although much of the Indigenous knowledge in Mqatsheni differs from school science content, stakeholders do have ideas about how local knowledge can contribute to science education at a local level. The community input does not suggest a curriculum overhaul at national level, but

does suggest sensitivity to issues of concern in the local context during teaching and learning – and top on this list are HIV/AIDS, teenage pregnancies, poverty and unemployment. The current CAPS documents provide a week-by-week teaching plan which leaves hardly any room for teacher creativity and response to context that were characteristic of Outcomes-Based Education, on which the NCS was based. The prescriptive nature of CAPS prevents local stakeholder input - which is a blow to relevance, inclusivity, human rights, social justice and democracy. The findings of this study indicate that the KZN Department of Education should consider local community input in science teaching and learning. Sensitivity to issues in the context of Mqatsheni, calls for the promotion of problem-based science teaching and learning which focuses on "authentic problems and place-based issues" (Bang & Medin, 2010:1024). There is need for in-service teacher professional development focused on skilling teachers for this type of teaching.

With regard to the community's request for practical skills, South Africa could learn from neighbouring Zimbabwe where students have to take at least two practical subjects in lower secondary school and at least one in third and fourth year, for the Ordinary Level examinations. School choice of practical subjects depends on relevance to context as well as affordability. The challenge for South Africa is how to reverse the thinking of the colonial and apartheid eras that associated manual labour with the 'inferior' race. No one can say with certainty whether it will ever be possible in South Africa to consider reviving the ideas of 'education with production', born during the struggle for liberation in Southern African countries, which was intended "to teach rural youth self-sufficiency and self-employment (Prew, 2013, p. 135). However, we learn from this study that the 'education with production' route is desirable in Mqatsheni.

This study documented IK as encountered in Mqatsheni. Although commonalities exist among Indigenous groups, scholars emphasise the plurality of knowledge and ways of living in nature that exist among Indigenous people (Aikenhead & Michell, 2011; Mbiti, 1969). "Each tribe, clan or nation has a unique set of understandings" that may be restricted to particular places (Aikenhead & Michell, 2011:72). South Africa is made up of many tribal groups and clans represented by the 11 official and many other languages. Different communities might have different ways of understanding nature, shaped by their natural environment and historical and social contexts. Therefore, the knowledge found in this context may not be applicable in another community. It would be helpful for the Department of Basic Education to initiate the documentation of IK for classroom teaching. I am aware that documentation is one of the Department of

Science and Technology's primary IK projects (Mosimege, 2005), but the Department of Basic Education has not been very active in this area. This study shows that when the knowledge of an area is understood, that knowledge could be appropriately applied in the classroom. This study has also shown that some knowledge, particularly that which involves practical skills, is getting lost. It would be beneficial for the preservation of IK, for curricula to acknowledge and include Indigenous Knowledge. As Odora Hoppers (2009) asserts, culture is not transmitted genetically. It has to be learned. The classroom offers a good space for such learning, particularly where teachers are from the same community, language and culture as the students, and where the community is invited to participate in the school activities.

8.5.3 IK research

This study has made a contribution in the field of research in IK-science integration, as well as in research based on ubuntu and transformative participatory methodologies. The study opened up spaces for creative and transformative teaching methods through its community engagement. One of the teachers acknowledged that she "learnt a lot", and that she had been "developed", in terms of her teaching through her involvement in this study. The students enjoyed the outdoor activities, and the Elders welcomed students into their homes for interviews. It is very significant that this study confirmed the potential of aligning research with ubuntu and collaborative methodologies. The outcomes of this study have gone beyond IK-science integration to participant empowerment through renewed thinking about resources at participants' disposal and the potential they can reach when they do not focus on deficits.

Although Mqatsheni is afflicted by disease, violence and death, it still holds onto, and sees potential in the ideals of *ubuntu.* If this study had been carried out in a less traditional community, such in a township school, it would probably have led to different results. The findings of this study need to be corroborated by further collaborative work with teachers and the community to confirm and strengthen the need to develop teaching and learning materials based on Indigenous knowledge found in such communities and on the principles of *ubuntu*. As Odora Hoppers (2010, p. 154) advises, "the path forward…is not just about becoming clever. It is about becoming more human". Humanness does not develop when we just talk about it, but rather when we practise it; hence *ubuntu* needs to be practised in both science education, and in science education research.

8.5.4 Reflecting back on the study

I brought into this study my own life experiences as described in Chapter 1, and many times I drew on those experiences to guide my relationships with students and adults in this study. The literature on indigenous methodology (Chilisa, 2012; Louis, 2007; Mertens, Cram & Chilisa, 2013; Smith, 1999) resonated with my experiences. I knew and understood the importance of language as an important factor for developing relationships. I understood the role of traditional leaders and how important it was to follow their guidance in matters that concern the community. I also understood the tensions that changes on the political front could bring in relationships between generations.

I also got to learn through this study. Firstly, I learnt how inappropriately framed my third research question was. Although I was aware of the interconnected and holistic nature of IK, I still went out looking for "aspects" of knowledge that could be used in school science. The findings from this study show that it is particularly inappropriate to think of the knowledge in Mqatsheni as divisible into groups of what can be used in science and what cannot. Secondly, I learnt that a consideration of ethics is an on-going dimension of research in communities like Mqatsheni. It is not the written document that matters in communities where there is little proficiency in reading and writing. Rather it is the community's own guidelines on what constitutes ethical relationships. Hence, long after University protocols had been signed and filed, the Secretary of the Traditional Council continued to seek the Elders' collective verbal consent at each meeting. The Elders asked questions and demanded answers, for example:

One Elder asked, *"Uzosisiza ngani?"* {How are you going to help us?}

And yet another asked, *"Inkulumo le, uzoyikhiphaphi? Ungasitshela njengoba sonke sila"* {Where are you going to publish this discussion? Can you tell us all as we are gathered here?}.

Representatives from government departments asked, *"How will this study benefit the community?"*

I learnt that in Mqatsheni ethics is a negotiated process and that although there are no written documents, the Elders have demands and protocols researchers are obliged to follow. I realised that the signed documents were for me, and not for them. I had created those documents. Besides having the Elders sign if they agreed to participate, there was no room for them to express their own thoughts. The consent documents were

therefore inappropriate for their purposes. Although they were not taking notes, they could still remind me of my earlier promises.

Thirdly, I got to understand the importance of making plans flexible and open to changing circumstances. Deaths, extreme weather conditions, adjustments to school activities and Department of Education activities involving teachers are not always possible to plan for at the beginning of a research study. I learnt to respond appropriately to circumstances, for instance, visiting a bereaved family; and the importance of planning for multiple activities so that when one is not possible to do, there will be an alternative.

Fourthly, I also learnt the importance of understanding issues and phenomena from the perspective of the community. My naïve excitement about snow (recorded at the beginning of chapter 2) was extremely insensitive, particularly in a context where poverty is a major concern. I learnt that failure to consider participants' perspective has potential to damage the development of relationships based on trust.

Lastly, I learnt that the life concerns of participants are an important aspect of the research outcomes. I went to Mqatsheni looking for knowledge and worldview. I came back carrying concerns about HIV/AIDS, orphans, child discipline, cattle theft, invasive plants, land shortage, poverty and crime. These concerns shaped the study context, and they helped me develop a better understanding of the participants and their needs for contextually relevant and respectful education that would not only prepare them for the potentials of life, but also for the maintenance of the knowledge and values that offer a sense of identity and belonging.

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APPENDICES

APPENDIX 1

Details of Fieldwork

Dates	Activities
1-4 August 2009	• Introductory meeting with representative of local Traditional Council; Khuphuka Director & Youth leaders; officials from the KZN Department of Agriculture, Environmental Affairs & Food Preservation; Special Projects Coordinator of KwaSani Municipality. • Introductory meeting with Principal and teachers • Addressing ethical issues • Questionnaire on rain
25-29 October 2009	• Meeting with Secretary of the Traditional Council • Planning meeting with teachers and research assistant • Student's writing – My future • Students' writing: A knowledgeable person in my area • Planning for 2010 SAARMSTE conference with participating teacher
11-16 Jan 2010	• Focus group discussion on issues arising from questionnaire responses • 'Traditional' games • Working with cameras • Planning activities with students • Planned meeting with representatives of the Traditional Council not done because someone in the village had died and many of the Elders spent much of the time with the family.
9-14 May 2010	• Student interview Elders • Games – Snakes & Ladders • First Focus Group Discussion with elders[62] • Planning for next trip with students, teachers and principal
25-29 May 2010	• Interviews with Elderly couples: The Zithas and the Shezis • Students' writing: respect • Students discussion: food in the community • Planning for next visit
21-28 August 2010	Trip was postponed due to a nationwide 3-week strike led by some teacher unions. Teachers were not going to school during the duration of the strike and so students were also not attending.
24-29 October 2010	• 2nd focus group discussion with Elders • Students' writing: food • Photograph assignment: things I wish I could understand better • Visit to Himeville Museum • Interview with Mr Michael Coles
5-9 December 2010	I had to cancel the trip because I had to undergo a surgical operation on 30 November. I could neither travel long distances nor do much work for 6 weeks.

[62] This FGD was based on similar questions as those used in student interviews. It was the same Elders who were interviewed by students who also participated in the FGD.

24-28 Jan 2011	I could not carry out the planned fieldwork in Mqatsheni due to heavy rain which rendered the place inaccessible. The principal and teachers who commute from Underberg could not get to school during that week. I had to change plans and use the time to carry out interviews with people who work (or have worked) in Mqatsheni: • Mr Sosibo (School principal) • Sister Abegail Ntleko (a retired nurse and founder of Clouds of Hope – a children's home in Underberg) • Jacqueline (one of the co-founders of Khuphuka)
21-25 February 2011	• Closure with 2009-2010 student participants[63] • Interview with Skhumbuzo • Addressing ethics issues with a new set of student participants • Student's writing: My future • Students' writing: Photograph assignment • Students' writing: A knowledgeable person in my area • Student's writing – Important things I have learnt at home • Meeting with elders: planning for hut construction
10-15 July 2011	The main focus of the trip was to discuss the progress of hut construction. It was not possible to have a meeting with the Traditional Council because there were other previously unanticipated meetings involving a number of the Council members. • Discussions with Mr Sosibo, Mr Myende and Mrs Mlibeni • Interviews with Mrs Luswazi; Mr and Mrs Duma and Mduduzi Majozi

[63] In our initial agreements with the school, the students would participate in Grades 10 and 11. Although the students would have preferred to continue participating in the project, it was in their interest to give themselves more time to work for their school-leaving certificate examinations. Therefore, after the formal closure with the first group, I started on establishing relationships with a new group of Grade 10 students.

APPENDIX 2

Ethics clearance certificate

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Khupe

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER H09/04/10A**
PROJECT TITLE	Indigenous knowledge and the Science Curriculum: Possibilities for Integration
INVESTIGATOR(S)	Ms C Khupe
SCHOOL/DEPARTMENT	Faculty of Science
DATE CONSIDERED	16/08/2013
DECISION OF THE COMMITTEE	Approved Unconditionally
EXPIRY DATE	15/08/2015

DATE 16/08/2013 **CHAIRPERSON** _____ (Professor T Milani)

cc: Supervisor : Dr M Keane and Dr A Cameron

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10003, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ **Signature**

_____/_____/_____ **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX 3



kzn education
Department:
Education
KWAZULU-NATAL

MS C KHUPE
UNIVERSITY OF WITWATERSRAND
WITS 2050
JOHANNESBURG

Enquiries: Sibusiso Alwar
Date: 23 November 2009
Reference: 0078/2009

RESEARCH PROPOSAL: INVESTIGATION ON THE INDIGENOUS KNOWLEDGE AND THE SCIENCE CURRICULUM

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

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educator programmes are not to be interrupted.
5. The investigation is to be conducted from 23 November 2009 to 23 November 2010.
6. Should you wish to extend the period of your survey at the school(s) please contact Mr Sibusiso Alwar at the contact numbers above.
7. A photocopy of this letter is submitted to the principal of the school where the intended research is to be conducted.
8. Your research will be limited to the schools submitted.
9. A brief summary of the content, findings and recommendations is provided to the Director: Resource Planning.

kzn education
Department:
Education
KWAZULU-NATAL

10. The Department receives a copy of the completed report/dissertation/thesis addressed to:

The Director: Resource Planning
Private Bag X9137
Pietermaritzburg
3200

We wish you success in your research.

Kind regards

R. Cassius Lubisi (PhD)
Superintendent-General
02/12/2009

...dedicated to service and performance
beyond the call of duty.

KWAZULU-NATAL DEPARTMENT OF EDUCATION
POSTAL: Private Bag X9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa
PHYSICAL: Office G25, 188 Pietermaritz Street, Metropolitan Building, PIETERMARITZBURG 3201
TEL: Tel: +27 33 341 8610/8611 | Fax: +27 33 341 8612 | E-mail: sibusiso.sivan@kzndoe.gov.za / smjeo.sikhakhane@kzndoe.gov.za

kzn education
Department:
Education
KWAZULU-NATAL

MS C KHUPE
UNIVERSITY OF WITWATERSRAND
WITS 2050
JOHANNESBURG

Enquiries: Sibusiso Alwar
Date: 23 November 2009
Reference: 0078/2009

PERMISSION TO INTERVIEW LEARNERS AND EDUCATORS

The above matter refers.

Permission is hereby granted to interview Departmental Officials, learners and educators in selected schools of the Province of KwaZulu-Natal subject to the following conditions:

1. **You make all the arrangements concerning your interviews.**
2. **Educators' programmes are not interrupted.**
3. **Interviews are not conducted during the time of writing examinations in schools.**
4. **Learners, educators and schools are not identifiable in any way from the results of the interviews.**
5. **Your interviews are limited only to targeted schools.**
6. **A brief summary of the interview content, findings and recommendations is provided to my office.**
7. **A copy of this letter is submitted to District Managers and principals of schools where the intended interviews are to be conducted.**

The KZN Department of education fully supports your commitment to research: **Investigation on the indigenous knowledge and the science curriculum**

It is hoped that you will find the above in order.

Best Wishes

R Cassius Lubisi, (PhD)
Superintendent-General
03/12/2009

...dedicated to service and performance
beyond the call of duty.

KWAZULU-NATAL DEPARTMENT OF EDUCATION
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kzn education
Department:
Education
KWAZULU-NATAL

MS C KHUPE
UNIVERSITY OF WITWATERSRAND
WITS 2050
JOHANNESBURG

Enquiries: Sibusiso Alwar
Date: 23 November 2009
Reference: 0078/2009

LIST OF SCHOOLS

1. KwaMvimbeni High School

Kind regards

R Cassius Lubisi, (PhD)
Superintendent-General
23/11/2009

...dedicated to service and performance
beyond the call of duty.

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APPENDIX 4

Invitation to take part in the Khuphuka research project

Traditional knowledge (also called Indigenous Knowledge) has helped rural communities live successfully on the land. In modern times some of this traditional knowledge is getting lost. In many parts of the world educators are trying to save and use Indigenous Knowledge (IK). In South African too, educators need to include some IK in school science. Who should say what IK should be included? I believe that the community should have a say about this. This is a small-scale research project that will not exploit resources or seek out protected knowledge. Its focus will be on common practices that may contribute to school science curriculum.

I am carrying out a three-year study through which I intend to explore local ways of knowing nature. I will request discussions with groups of elders, students and teachers. I will invite interviews with some members of the community, carry out observations of some of their activities, and in some cases also take photographs, if you agree with that. I intend to hold meetings and workshops to plan and carry out activities that may encourage the use of local indigenous knowledge with the hope of contributing to the school science.

1. I kindly request your participation in this project. Participation is entirely voluntary and you are under no pressure to participate or to answer questions. If at any time you cannot carry on, you are free to withdraw from participation. You will not be penalized in any way if you do not take part in this research.
2. I request that your answers to questions be frank and honest (whether positive or negative). Information from this research will be used only for research and educational purposes. If you so wish I will not have your name appear in report findings, but with your consent I can report your name as a co-participant and IKS holder.
3. I appreciate your own busy schedules and will try not to make this research a burden by carrying out interviews when it is most convenient to you.
4. I think the research will be of benefit to us all. It will help us know what Indigenous Knowledge is in this community and how it can be used in school science. This way, your views may get to the Department of Education. This is hoped to help students learn better. The research will also give IK holders an opportunity to share their knowledge with the community especially the youth. The research is likely to open chances for dialogue between the school and the community. I will at all times be guided by the wishes of the community as I acknowledge that IK may be a sensitive issue.

If you have any questions about the research, please feel free to raise them. My contact number is 078 565 3007.

The consent form is also available in isiZulu.

APPENDIX 5

Consent and Assent Forms

Informed Consent Form (for adult participants)

I ……., have read and understood the conditions under which this research is being carried out. I understand that participation is voluntary and that if I choose to participate, I am free to withdraw from the study at any time, and this will not prejudice me in any way.

I therefore agree/disagree (delete inapplicable) to take part in this research.

Signed ……

Date ……

Consent Form for Recording

Dr Moyra Keane and Mrs. Constance Khupe

March 2009

Name ……

Grade ……

Request

As part of the **Khuphuka Research Project** we may gather the following:

1. Photographs
2. written stories
3. videos and tape recordings

We ask your permission to use these as part of research reports. Please tick in the boxes to say yes or no in the table below.

	Yes	No
1. Photographs		
2. Written stories		
3. Video tape recordings		
4. Tape recordings		

Would you prefer to use your real name or made-up name in the report? Please tick in the box below.

Use my real name	Yes	No	**Use made-up name**	Yes	No

Signature of student ……..

Signature of Guardian …….

Date ……..

Guardian Consent Form

I ……., being the parent/guardian of ……....., have read and understood the conditions under which this research is being carried out. I understand that participation is voluntary and that if my child chooses to participate, she/he is free to withdraw from the study at any time, and this will not prejudice him/her in any way.

I therefore agree/disagree (delete inapplicable) that she/he takes part in the research.

Signed ……

Date ……

Principal's Consent form

I ……..……., the Principal of ……..…….. School have read and understood the conditions under which this research is being carried out. I understand that participation is voluntary and that the learners who choose to participate are free to withdraw from the study at any time, and this will not prejudice them in any way.

I therefore agree/disagree (delete inapplicable) that learners take part in the research.

Signed ……

Date ……

Minor Assent Form

I ……., have read and understood the conditions under which this research is being carried out. I understand that participation is voluntary and that if I choose to participate, I am free to withdraw from the study at any time, and this will not prejudice me in any way.

I therefore agree/disagree (delete inapplicable) to take part in this research.

Signed ……

Date ……

Research Assistant Agreement of Confidentiality

I, ……. fully understand that any documents, data, information (electronic, written or verbal), that I have access to in my capacity as research assistant for the **Khuphuka Research Project** is strictly confidential.

At no time may any of this information be given out without permission of the research supervisor.

I undertake to return all data and reports at the end of the assignment.

Ownership of all reports and analysis belongs to the **Khuphuka Research Project.**

Signed ……..

Date …….

APPENDIX 6

Student participants

Girls	Boys[64]
Agrineth Duma	Bongani Majozi
Bonakele Mbhele	Daniel Chagwe
Constance Zondi[65]	Fanelesibonge Miya
Doreen Zondi	Herbert Dlamini
Fikile Shezi	Lungisani Chagwe
Happiness Zondi	Mbulelo Ntshele
Kholeka Zuma	Mexwell Duma
Khonziwe Memela	Mondli Mthalane
Lindisiwe Mohlakoana	Nkululeko Mazeka
Lindiwe Duma	Nkululeko Mbatha
Londeka Mncwabe	Qiniso Miya
Lucia Bhengu	Sabelo Dlamini
Lungile Shezi	Sibongiseni Zondi
Makabongwe Zondi	Siyanda Mthalane
Neliswa Shabalala	Sphamandla Mkhize
Nobesuthu Majozi	Thulani Shezi
Nokulunga Mbongwa	Victor Mthalane
Nombuyiselo Ngcobo	Vumani Mthalane
Nomvelo Mncwabe	Wiseman Molefe
Nomvuyo Zondi	
Nomzamo Sithole	
Nondumiso Dhlamini	
Nondumiso Mazeka	
Nonkazimulo Zondi	
Nozinhle Majozi	
Ntombenhle Zondi	
Patience Majozi	
Phelile Zondi	
Philile Peggy Zondi	
Phumla Majozi	
Sanele Majozi	
Sindiswa Mthalane	
Siphesihle Majozi	
Veronica Sosibo	
Xolisile Luswazi	

[64] Enrolment figures the school reflect lower numbers for boys than girls. There is no clear explanation why this is so.

[65] The students' common surnames indicate that many families in Mqatsheni share common ancestry. Student participants in this study include 10 students from Zondi families and 7 from the Majozi families.

APPENDIX 7

Participating Elders

Members of the Maguzwana Traditional Council	Elders not in Traditional Council
Mr Mhlophe (Acting Chairperson) Ms B.D. Majozi (Secretary and Treasurer) Mr N. Duma Mr Z.F. Myende (iNduna) Mrs N. Sibhuku (councillor) Mrs H. Zondi Mrs P. Luswazi (councillor) Mrs F. Mthalane (councillor Mr Veseli Mr P. Mthalane Mr A. M. Duma (iNduna) Mrs Xaba Mr B. Bhengu Rev P.W. Cekwane (councillor)	Mr A. Zitha Mrs Zitha Mrs Duma Mrs Shezi Mr Shezi Mrs N. Mlibeni Mr A. E. Majozi

APPENDIX 8

Schedule for FGD 1 and Interviews with Elders

1. In what ways do you find your experience of growing up similar to or different from that of children today? Please explain.
2. What special knowledge or skills did you acquire as you were growing up which you think is particularly valuable to you, your family and the community?
3. How did you acquire the knowledge and/or skills?
4. Do other community members know you have this skill/knowledge? Do they come to consult?
5. Do any teachers know you have the skill/knowledge? Would you like to share your knowledge with the students and teachers? In what ways do you think that can be done?
6. Nowadays children learn both at home and at school. In your opinion, how relevant to life in Mqatsheni are the things learnt at school?
7. In what ways do you think the youth can be better prepared for adult life?

APPENDIX 9

Questionnaire on Rain

The information we know about nature usually comes from either home or school. Some of the information we get from home may differ from that which we get from school. Rainfall is part of our life experience. The following questions will help us find out what your own ideas are about rainfall. Please answer the questions as fully as you can. If you are not able to an answer a question, leave the space blank and go to the next.

1. What is rain?

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2. How is rain formed?

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3. During which months of the year does Mqatsheni area receive most rainfall? Why do you think most rain falls at this time?

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4. Rain is sometimes accompanied by lightning and thunder. Why is this so?

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5. Can people do anything to prevent lighting and thunder? Please explain

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6. Sometimes rain does not fall when it is expected and there is drought. Why do you think this happens?

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7. Can people do anything to prevent drought? Please explain.

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8. How did you come to know this information?

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9. In your opinion, which of the two, home knowledge or school knowledge do you find more useful to everyday life? Explain your answer.

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10. Would you like to learn about home knowledge at school? Give reasons for your answer.

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11. If your answer to Question 10 was ‘Yes’, suggest examples of home knowledge that could be included in school science.

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APPENDIX 10

THE IMPORTANT THINGS I HAVE LEARNT AT HOME

Name	Theme	Quotes	Meaning
Bonakele	• Respect (for both old and young) • Chastity (*ukuziphatha*) - for full lobola and for protection against incurable diseases. • Being exemplary to other children in your own family and in the wider community	*…kumele uzigcine ukuze uyothi uma usulotshololwa kuyophuma izinkomo ezingu 11 ngeyamama yokumbonga ukuthi ukwazile ukuyala wakufundisa ukuziphatha.*	…you must look after yourself so that when it is time to get married [the groom] pays 11 herd of cattle including my mother's, in gratitude that she knew how to teach chastity[66].
Nomzamo	• Respect (for both old and young) • Service: cooking & being helpful at home • Chastity • Importance of (school) education		
Neliswa	• Respect	*Inhlonipho yinto yokuqala oyithola ekhaya.* *Inhlonipho yinto okuyiyo ekwakhela ikusasa eliqhakazile.*	Respect is the key value you get at home. Respect is what builds you a blooming future.
Ntombenhle	• Respect (as in obedience; not looking older people in the eyes; speaking only when invited to).	*Uhloniphe omdala nomcane ukuze insuku zakho zande ezweni.* *Uma ubaphatha kahle abanye abantu nawe uzophatheka kahle.*	Respect both the older and the younger so that your days may be increased[67]. If you respect other people you will also be respected.
Constance	• Service: chores • Personal cleanliness • Respect (old and young; familiar an unfamiliar). Kneeling to older people; handing things using both hands.		
No name	• Respect (no elaborations)		

[66] Bonakele's prime reason for chastity is interesting: she is not thinking of her own protection e.g. against HIV but considers more family gratification through lobola.
[67] Seems to be influenced by Christianity.

Lindiswe	• Hospitality • Respect (not looking older people in the eyes) • Service: waking up early to do domestic chores	*Ngafundiswa ukuthi intombazane ayivuki sekuphume ilanga.*	I was taught that a girl should not wake up after sunrise.
Happiness	• Respect (old and young) • Service: Look after family livestock/property		
Fikile	• cleanliness • Respectful relationships • Hospitality	*Bangifundisa ukuthi umuntu ungambekeli phansi.* *Uma kufika umuntu uyabingelelwa, nokuthi akaphumi engazange adle , noma umenzele itiye*	They taught me not to look down upon anyone. When someone is approaching, you must greet them; and that you should serve them something before they leave, e.g. tea
No name (male)	• Respect (old and young) • Peace: not to fight • Trust: to confide in a trusted member of the family in case of a problem • Hard work at school • Confidence • Chastity: keeping away from women because I am still too young and should focus on school work • Being thankful for all help given • Service: to also be helpful	*Ngingalwi nomphakathi kepha ngixoxisane nawo.* *Ngingasithandi isimame noma ngingathandani naso ngoba angikabi naso isidingo saso okwamanje ngoba ngisa bhekane nemfundo ukuze ngingaphazamiseki ezifundweni zami.* *Ngibonge uma kukhona umuntu ongipha usizo ukuze angisize nangelinye ilanga, nami ngimsize umuntu uma exakekile ukuze nabo bengisize. Ngoba ngokusizana singenza okuningi kakhulu.*	I must not fight but talk peaceably. I must keep away from women but focus on education, because it's not yet time. I should not be distracted from education. That I should show gratitude to anyone who has helped me so that they may help me again someday. I should also help those are facing problems so that they may also help me. By helping each other we can achieve a lot[68].
Nomvuyo	• Personal cleanliness • Service: Domestic chores • Respect (greetings; not listening in to older people's conversations)		
Londeka	• Hospitality		

[68] emphasis on returning good for good as an ingredient for development

Observations

- Students indicate that they learn values from home.
- Most common values learnt have to do with relationships: respect, service to others, gratitude, returning good with good, and hospitality.
- Other values: chastity, personal cleanliness, hard work, confidence.
- Data from this task answers RQ2.

APPENDIX 11

WORKSHEET 1: GRASS-THATCHED HUTS AND HOUSES IN MY COMMUNITY *(IZINDLU ZOTSHANI)*

This task is about thinking and finding out more about huts and houses built the traditional Zulu way. Please answer the questions in the spaces provided. You can answer in isiZulu or in English.

1a) What materials are used to build the huts or houses?

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b) Think about the materials you listed in 1a) above. Why do you think it is important to use those materials?

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2a) Do you think it is important to build huts the traditional way? Give reasons for your answer?

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b) When you grow up and can build your own home, would you build it the traditional way or the modern way? Give reasons your answer.

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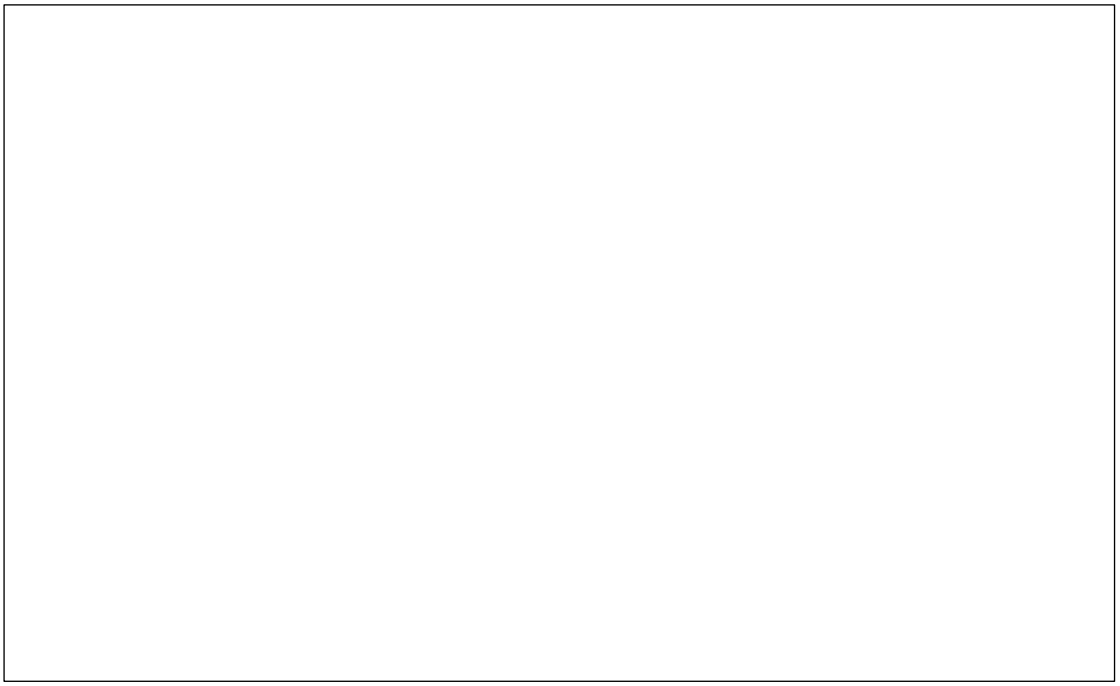
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3. Draw a labelled diagram of a hut. Briefly explain the function of each part of the hut you have labelled



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APPENDIX 12

Zulu traditional household items



Unyazo (serving bowls) and *izikhetho* (dishing spoons)



Amacansi (reed mats)



Imbiza (clay pots)



Ugqoko (serving platters)



Ilitshe (grinding stone)