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South African Grade 9 teachers' and learners' knowledge about medicinal plants and their attitudes towards its integration into the science curriculum

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CHAPTER ONE: INTRODUCTION

1.0 General Introduction

In this chapter I explore the background to the study and lay a foundation for the discussions that ensue in the proceeding chapters by describing the South African curriculum context, the problems motivating the study and my research objectives and questions.

The integration of indigenous knowledge systems (IKS) into the mainstream science curriculum has been advocated for by science educators around the world (Ogunniyi, 2010 in South Africa; Vhurumuku & Mokeleche, 2009 in South Africa; Shumba in Zimbabwe; Odora-Hoppers in South Africa; Nge'tich, 1996 in Canada; Ogawa in Japan; Lawson, 1978 in USA) as well as Education Policy (DOE, 2003). It is widely accepted that the success of such curriculum reform efforts are likely, to a large extent dependent on the teachers' and learners' attitudes and values regarding the integration of IKS into the school curriculum (Webb, Ogunniyi, Sadek, Rochford, Dlamini & Mosimege, 2006). Both teachers and learners are important stakeholders in any curriculum development and change process (Kelly, 1986). According to Le Grange (2007) the integration of indigenous knowledge systems into sciences curricula depends on "teachers' understanding" of the interaction between Western and indigenous world views. In their study, Webb et al. (2006) sought to find out the understandings of IKS held by student teachers. Such understandings, which to some extent are their perceptions of IKS, may determine their attitudes towards the integration of IKS, into the mainstream science curriculum. The debates around the need to acknowledge the dual nature of scientific knowledge systems-Western science and indigenous knowledge are extensive in the literature; it is the nature of the IKS that needs exploration (Le Grange 2007). My research explores the indigenous knowledge of traditional medicines that science teachers and learners bring into the classroom. It also seeks to ascertain teachers' and learners' attitudes towards science-indigenous knowledge integration.

From personal experiences, and also according to (Kelly, 1986), the success of any innovation in education appears to depend, amongst other factors, on the attitudes and perceptions that role players, mainly learners and educators have concerning

the innovation. Knowledge about traditional medicines is arguably widespread in African cultures especially in the rural areas. The attitudes and perceptions that educators and learners have towards the efficacy and potency of traditional medicines may influence the success of the integration of such indigenous knowledge into mainstream science. It is therefore important that the attitudes and perceptions of the educators and learners be investigated in order to assess the potential for any integration intervention and come up with suggestions for improving the overall teaching and learning of indigenous knowledge in the classroom.

The inclusion of IKS in the curriculum creates a challenge for the science educators who have to identify various aspects of IKS and work out how to integrate them into the school science curriculum. One of the challenges is caused by the denial of the existence of IKS that can be integrated with school science by some educators (Manzini, 2000). It should however be realized that there is 'science' in IKS (Ogunniyi, 2007) and this 'science' component of IKS could be relevant for integration with the school science. The calls for integration have been heeded by the South African government as reflected in their curriculum and policy innovations which I will now discuss.

1.1 The South African curriculum context

With the coming of a democratically elected government in South Africa, came a need to introduce various changes on the political, economic and educational fronts. Educational reforms were necessary to redress the imbalances created by the apartheid educational system that was designed to limit the kind of knowledge that the black child had access to. Curriculum 2005 (C2005) a radical innovation to the school curriculum was officially introduced in South Africa in 1998 and has its roots on an outcomes-based education model. The concept of outcomes based education (OBE) espouses a shift from inputs to the products or outputs of an educational system hence a list of seven critical and five auxiliary outcomes were spelt out as the target outcomes. Curriculum 2005 (DOE, 2003V), was replaced by the National Curriculum Statement (NCS) in 2002 and later revised to the Revised NCS– Natural Sciences for Grades R-9 which clearly advocated for the incorporation of indigenous knowledge into the science curriculum (DOE, 2003). This curriculum statement document pre-supposed that the educators are aware of the various indigenous

knowledge systems. This is however not always the case. In the Natural Sciences RNCS, Learning Outcome 3(LO3) stipulates that learners must learn science within the context of their historical, societal and cultural knowledge and values (DOE, 2002 p. 20). In the Physical Sciences RNCS, LO3 stipulates that learners should understand "other systems of knowledge, such as indigenous knowledge systems" (DOE, 2003 p. 11).

It is therefore imperative that science educators devise ways to make science relevant to the lives of the learners. C2005 emphasised learner-centred teaching strategies and was not prescriptive of the depth and scope of the content to be taught, leaving the decision solely to the teachers. This was an attempt to directly counter the rote learning and authoritarian system that characterised the apartheid government policies. The learner-centred approaches to teaching that are inspired by constructivism are currently being advocated for in schools. These approaches demand that, amongst other tasks, a teacher should investigate learners' prior knowledge. This prior knowledge may be linked to their indigenous knowledge. Prior knowledge is important in determining what a learner could learn and informs the teacher of what teaching strategy they may adopt. The current Curriculum and Assessment Policy Statement (CAPS) which was initiated in 2012 for grade 10 at secondary level also clearly advocates for the incorporation of IKS in teaching and learning. Indeed, one of the guiding principles of CAPS is valuing indigenous knowledge systems and acknowledging the rich history and heritage of this country (DBE, 2011 p. 5). The question is – are the policies being implemented as intended? The problems hindering successful implementation motivated my study and I will now discuss them.

1.2 Context of the problem

As a teacher I cannot help but notice that very little, if any, indigenous knowledge seems to be taught in the Natural Sciences, and a review of the textbooks suggests that where indigenous knowledge is included, it is simply as examples tacked on (e.g. treatment of diseases of various human systems covered in the curriculum). Keane (2007) observes that attempts to include IK in textbooks often consists of

selecting “bits that fit” with the syllabus in a way that diminishes the holistic nature of indigenous ways of knowing. The question that arises then is whether the integration of indigenous knowledge into mainstream science was well thought out or is it mere ideological rhetoric based on political or socio-economic policies.

Several factors might be limiting the more integrated use of indigenous knowledge in science classrooms. Firstly, some teachers are not well informed about the various indigenous knowledge systems that typify the multi-cultural situation in South African classrooms, as they have been schooled in western science (Ogunniyi, 2007). The challenge is in the identification of the relevant IKS that can be integrated into school science.This inevitably creates a theory-practice gap which may hinder successful implementation of reforms as teachers play a pivotal role in the implementation process. Many South African learners have strong roots in their cultural IKS yet when compared to western science, from my experience as an expatriate teacher, IKS is given low status or completely ignored during their learning. The primary task is to identify what exactly IKS a particular society possesses and which forms should be incorporated into the curriculum. It is important to note that IKS is not limited to science education but rather it encompasses other facets of life like agriculture, engineering, medicine, history and the concept of *ubuntu* – humanism (Odora Hoppers, 2002). It is the interconnectedness of the tenets of IKS that makes it dynamic and holistic. Incorporation of IKS and other worldviews may thus produce a comprehensively educated individual who will be able to contribute positively to the development of society hence empowering the community against the hegemony of western knowledge. Hoppers (2002, p 8) sees IKS as “a national heritage and a natural resource that should be protected”. I subscribe to this view. There is no better way to protect the resource than to incorporate it into the curriculum so that it can be transmitted from generation to generation.

Secondly, Archer (2010, p. 70), while endorsing the need for a reciprocal curriculum, argues that a “complete equality of cultural trade is perhaps too ambitious and unrealistic”. It is possible that research is able to identify practices that are common to a number of African cultures. Indeed that is what this research aims to explore. In conforming to the “learner-centeredness” tenet of the new curriculum, teachers need to see each child as an individual, “and therefore the needs and wants of each child

must be met" (Sanders & Kasalu, 2004). But many classrooms in South Africa are very multi-cultural, and the variation in cultures may impede the implementation of this tenet – there is not just one cultural knowledge system to deal with.

Thirdly, there seems to be a great deal of resistance from people (including some science teachers) who see indigenous knowledge as interwoven with superstitions which they feel have no place in science (Green, 2012). In reality traditional cultures have developed their knowledge of medicines through years of "trying and testing", and there is a strong "science" basis to many medicines, now being exploited by pharmaceutical companies. It might be difficult for some teachers to clearly tease out the factual indigenous knowledge, considering the nature of science, and that which is based on myths and beliefs. While the latter could provide a good starting point for lessons, the indigenous knowledge is what science teachers may be interested in teaching (Moyo, 2011). This may be particularly true regarding the varying knowledge about traditional medicinal plants. Traditional medicine is widely practiced in both rural and urban contexts. It is potentially a relevant place to look for examples of content and context that may be included in the science curricula.

1.3 Rationale for the study

One of the challenges faced by educators is to make the content of their lessons relevant and applicable to the learners' lives. This challenge could be partly overcome if more of what learners are engaged in during class is derived from events and phenomena in their immediate environment – both physical and cultural. For example, it may not be entirely necessary for learners in a remote rural setting to spend more time learning about electricity which they have never had access to, than learning about animal behaviour and conservation of forests which they observe each day of their lives. In other words learning in an African setting should not be divorced from the living experiences of the learner. It would, however, be an enormous challenge for curriculum developers to develop different curricula for the different environmental contexts where this is seen as necessary.

In South African schools, mainly the urban and township, classrooms are inherently multilingual and multicultural. Learners are exposed to a traditional worldview based on cultural beliefs and values and a scientific worldview. The challenge for teachers

is to ensure that transitions from their traditional worldview to the scientific worldview must be smooth (Aikenhead, 1996). The shift from one worldview to the next in a classroom environment is what Phelan, Davidson & Cao (1991) call “cultural border crossing”. Inevitably one worldview tends to dominate the mind of the learner especially the scientific worldview if one is to pass examinations. However, learners are observed to subconsciously hold on to their traditional beliefs (Fakudze & Rollnick, 2008). Teachers ought to be aware of the differences and similarities between the scientific and indigenous knowledge based worldviews especially from the learners’ viewpoint. The dualistic worldview if not “properly ameliorated or related could create potential cognitive dissonance” (Webb et al., 2006). By investigating the perceptions of learners, potential cognitive conflicts could be identified and this could help teachers to help learners resolve such conflicts. Webb *et al. (*2006 p. 716) believe that the cultural beliefs that teachers have may have a direct influence on “teachers’ instructional practices as well as learners’ predisposition to study science”

It is also imperative to inculcate a sense of ‘Africanness’, (Higgs 2008, p. 453) in the content that is taught to an African child. This enables children to develop their own identity which may be tied to their origins. Presently the science content appears by design to be mainly ‘western’ influenced as is observed in many syllabi in African countries which are merely cut and pasted from Western countries’ syllabi (Odora Hoppers, 2002). The cry amongst teachers is for an educational curriculum in science that should have ‘African science’ (Higgs, 2008) as the focus. Currently most of this ‘African Science’ is under the custodianship of traditional health practitioners and a society’s elders.

There is a growing interest in herbal medicines to treat various ailments especially with the search of a cure for HIV/AIDS. In South Africa, a visit to Faraday taxi rank in Johannesburg and other vegetable markets may confirm the increasing number of stalls for selling traditional medicinal plants. A thorough knowledge about these medicines is necessary in order to judge the true efficacy of these medicines. This is outside the scope of this research. However a starting point could be an investigation of what a particular society believes to be effective herbs to treat common ailments as this investigation purports to do.

It is important that factors which might be preventing the laudable addition of IKS to the school curriculum be researched. For example, the knowledge and attitudes that teachers and learners have need to be investigated in order to assess the chances of success of the integration. Teachers' knowledge and understanding of science is known to influence the way they teach in the classroom (Newton, Driver & Osborne, 1999). It is also important to value marginalised epistemologies and identities for the sake of human rights, democracy and reshaping education (Keane, 2007). South Africa, being a democratic country, should also be seen to be practicing what it preaches by engaging with the views of stakeholders in education including learners on curriculum issues.

It can be argued that some indigenous knowledge constitutes science and this knowledge could have been and can still be the stepping-stone for western scientists. Ulluwishewa (1993) in Mtshali (1994:4) views indigenous knowledge as a people-derived science that represents people's creativity, innovations and skills. In this study I have the view that indigenous knowledge is knowledge that:

- Potentially links African science and Western science,
- may motivate South African learners into liking science, which could improve on their poor performance,
- may lead to the conservation of the fauna of the environment.

The findings of this study may equip me with the necessary background knowledge to teach about traditional medicines and this could be shared with other colleagues through publication. The attitudes of learners that are determined may also encourage me to alter my pedagogic practices in order to facilitate smooth border crossing in the learners. This may result in more effective teaching and learning taking place in my classrooms.

1.4 Aim and Research Questions

The purpose of the study was to elicit learners' and teachers' knowledge about traditional medicinal plants and their attitudes towards integration of that knowledge into the science curriculum. This was with a view to exploring any differences or

similarities between the views of teachers and learners. The differences in attitudes could create “conceptual conflicts” within the learner (Hewson, Javu & Holtman, 2009). These concepts are again discussed in detail in Chapter 2. Cognitive dissonance or conceptual conflicts refer to the “confusion” or misunderstanding which results from the presentation of a new concept or approach which is in conflict with existing concepts, attitudes or beliefs. In order to resolve this conflict a new state of equilibrium needs to be found. Mental structures need to assimilate the new information or reconcile new input in order to cope with a situation. This is a common experience for pupils learning science. This situation may be exacerbated when a teacher and a learner have different interpretations of a concept and the teacher is unaware of this conflict. While this is true in any science classroom and is a usual part of learning, the situation is amplified when cultural aspects come in to play (Cameron, 2007). By having a better awareness of different cultural perspectives and concepts, some progress could be made in broadening the science curricula to include aspects of IKS. My study aimed at identifying the different traditional medicines in use amongst different cultures in a township class. It identified some knowledge that may be appropriate to integrate with the science curriculum. Ultimately the findings of my study may introduce ways in which science and indigenous knowledge may be integrated in the classroom and also identify possible impediments to and opportunities for this integration. Amongst the learners, the project may encourage them to value their traditional knowledge.

The following questions were used to guide the study;

1. What knowledge about a selection of traditional medicines for treating common ailments do Grade 9 Natural Sciences teachers and learners have?
2. What are a group of South Africa Grade 9 and 10 teachers’ and learners’ attitudes about integration of medicinal plant knowledge into the school science curriculum?
3. How do the knowledge and attitudes of teachers and learners compare?

1.5 Context of the study

The study was conducted in the high density suburb of Meadowlands in the township of Soweto, south west of Johannesburg. The lifestyle of the residents typically represents the lifestyle of the majority of black South Africans living in township areas. The use of traditional medicinal plants appears to be a common practice. I draw on my experience as a Zimbabwean and notice similarities in the contexts of the two countries. Indeed, there are many Zimbabwean teachers and learners in South Africa so some of the references I make – I take to be relevant to both countries. The school is my place of work – a secondary school in Meadowlands which I will title school G. More details about the context are discussed in Chapter 3.

1.6 Limitations of the study

In some South African and Zimbabwean cultures, divulging the details of traditional plant healing is generally taboo. Practical aspects of traditional plant healing for example the composition of concoctions are very secretive hence questions around practical aspects were avoided in interviews. Discussions around traditional medicinal plants are, as observed in this study, sensitive. Some learners were reticent and shy to talk openly. I had to ensure that learners were as comfortable as possible by reminding them of my assurances about confidentiality of information supplied and having casual eye contact during interviews. Difficulties in expressing themselves in English and interpreting questionnaire items were also observed. During the debate the teacher permitted use of local languages only when a learner tended to stammer. I had to ask the other learners to help me with interpretation.

Balancing my work and the research was a big challenge as they were always some clashes in my time schedules. I found myself working, especially marking, during very odd hours in order to compensate for the ‘lost’ time. I had to do this in order to avoid disadvantaging learners at my school due to my research activities.

Another challenge experienced was that of teachers’ reluctance to be audio-tapped yet they had initially consented to. This might have been due to the sensitivity of the topic. I honoured their wishes but I had to write notes as fast as I could in order not to forget the contents of the interview.

1.7 Delimitations of the study

The research mainly focused on learner participants residing in and around the Meadowlands area of Soweto in Johannesburg. The teacher participants work within the Meadowlands area schools.

1.7 Definition of key terms as used in the study

Indigenous – In this case African indigenous knowledge- belonging to a geographical area having developed over long periods of time or completely originated in the area and passed from generation to generation. In this study there were possibly a number of Indigenous knowledges of different cultures since participants originated from different parts of the country.

Indigenous Knowledge Systems - the practices developed by a group of people to interpret their physical and social environment and are passed from generation to generation. Knowledge that participants have due to their home and cultural background; knowledge coded in their mother tongue.

Traditional – the handing down of beliefs, customs through generations. Used here as a synonym for indigenous.

Traditional medicines – the medicines derived from plants (roots, tubers, stems, branches or leaves) which are believed to have curative properties in the various cultures in South Africa.

1.8 Significance of study

The study is expected to add to the information that is currently available regarding the knowledge possessed by teachers and learners on use of traditional medicinal plants. It will also add to our knowledge about teachers' and learners' attitudes towards integration of science and IKS. This information might be relevant to curriculum developers as they develop learning materials that incorporate relevant IKS. Methods of teaching about IKS in the science classroom may also be developed. As a science teacher, the findings of this study may equip me with the necessary background knowledge to teach about traditional medicines and this could be shared with other colleagues. Similarly the participating teachers are also

expected to improve their practice hence overall contribute to human resource development. The attitudes of learners that are determined may also encourage me to alter my pedagogic practices in order to facilitate smooth border crossing in the learners. This may result in more effective teaching and learning taking place in my classrooms. The study may also serve to learners' and my personal knowledge about traditional medicinal plants.

The proceeding section is a review of the literature related to my study. It is an analysis of the viewpoints of some scholars on the need for Science-IKS integration and the merits or demerits of such.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

The previous chapter set the context and outlined and delimited the problem investigated in this study. This chapter is a review of the literature related to the importance of traditional medicinal plants in Southern Africa and some proven pharmaceutical applications. I also give a brief synopsis of previous relevant research studies and define and discuss the main theoretical concepts. I highlight some of the African experiences about IKS integration into the science curriculum and also cite findings from similar initiatives internationally. In this study I draw on the concepts of constructivism, socio-constructivism, collateral learning and cultural border-crossing.

2.2 Why traditional medicinal plants

Growing up in Zimbabwe, in a Christian society that often despised traditional practices including the use of medicinal plants, it is exciting to discover that traditional medicinal and indigenous knowledge are now promoted by a number of government departments[1] and medicinal plants are widely used even amongst some Christians and those scientifically educated (Shumba, 1999). My family, both nuclear and extended, generally embraced both traditional and Christian practices. Our lifestyles have changed compared to the period in which I grew up over 20 years ago. There is a significant shift towards a more tolerant attitude to the use of traditional medicinal plants; or even a more activist attitude in the reclamation of marginalized knowledge.

In Zimbabwe the number of traditional healers has dramatically increased since the attainment of independence (Machinga, 2011). In 1985, the number of traditional healers stood at 8,122 (one for every 575 people in Zimbabwe) compared to only 800 registered medical doctors, and in 2001 there were 45,000 traditional healers compared to 1,400 medical doctors in Zimbabwe (Machinga, 2011). Machinga (2011) argues that in Zimbabwe, people visit traditional healers, prophets from "Churches of the Spirit" (*chechi dzemweya* in Shona), hospitals and clinics for

[1] Department of Trade and Industry(DTI);Department of Education(DoE);National Research Foundation(NRF)

medical treatment. Churches of the spirit are Pentecostal churches that supposedly combine Christianity and traditional ways of healing for a holistic treatment. Diseases or sickness are viewed not only as physiological and/or psychological but also having a religious component. Often Zimbabweans combine all available sources of treatment to cure diseases and especially resort to the traditional ways when the western ways have 'failed'. Interventions extend beyond the treatment of physical symptoms but go further to address social and spiritual aspects, too (Machinga, 2011). The physical symptoms are treated using herbs whereas the social and spiritual aspects are addressed through rituals and sacrifices which normally involve a community. It is common practice even in present day to have entire communities invite a traditional healer (*Tsikamutanda* in Shona) to cleanse an entire community. These practices also seem to be prevalent in South Africa.

I now discuss health aspects claimed for traditional foods; specific uses of some medicinal plants, examples of other traditional healing practices of Southern African ethnic groups, as well as the use of traditional pharmaceuticals by drug companies.
In a study to investigate the potential health benefits of indigenous foods in Limpopo Makuse and Mbhenyane (2011) found out that some indigenous green leafy vegetables have a high content of omega-3-fatty acids per fatty acid content. They identified indigenous food items such as the African pumpkin- a tendril bearing climber- *Mormodica balsamina (Mokhutsega* in Northern Sotho, *Nkaka* in Xitsonga and *Tshibavhi* in Tshivenda) were used to treat and prevent hypertension and diabetes mellitus. Some of the food items that were mentioned to treat diseases were small pigweed- *Amaranthus thurnbergii* and pigeon pea leaves- *Cajanus cajan* for the prevention of constipation. Donkey milk is taken to treat whooping cough. It is worth noting that there seems to be cross-cultural agreement in terms of the practices and use of these remedies. These examples illustrate use of herbs (a universal practice), however there are also some other esoteric practices that are secret and sensitive and are beyond the scope of possible topics to be included in the current science curriculum. Hence my study is limited to the herbal medicines used for treatment of common ailments

Odora Hoppers (2010) asserts that African indigenous medicine is well established in its various forms, such as use of herbs, psychotherapy, knowledge of anaesthetics

and antiseptics (Odora Hoppers, 2010). Interestingly, Odora Hoppers (2010) also claims that Indigenous African medicinal knowledge included obstetrics medicines for facilitating abortion, retarded labour and surgery including Caesarean sections. It is also important to add that in several African societies, for time immemorial people have been conducting circumcisions with anaesthesia. However, it is unfortunate that some of these traditional practices are marred by reports of malpractices that have resulted in deaths. The Department of Health, which is sometimes expected to monitor the traditional practices especially at initiation schools, is actually blamed for some of these deaths (*The Star*, Friday, May 17th 2013). Anaesthesia in such initiation schools is achieved through traditional medicines. In South African public health centres, women are normally discharged from maternity wards 24 hours after normal deliveries. This appears to be a bit too early in the post natal period. The result is that postnatal care is provided by family members and grandmothers who are often assisted by traditional birth attendants and traditional healers. It is these indigenous ways of treating or preventing ailments (in newborns) that may be another aspect that could be investigated by curriculum researchers for possible documentation and inclusion in the science curriculum.

New sources of pharmaceuticals are developing as a result of continued research in African traditional medicines that make extensive use of medicinal plants. Through such research, several biologically active compounds have been found not only in South African plants but globally. Xaba (2012) estimates that nearly half of the medicines produced by pharmaceutical companies are derived from plants or their products. Rabe & van Staden (1997 p.81) note that a large proportion of the South African population use traditional medicine for their physical and psychological health needs. The use of traditional medicinal plants is not confined to rural areas. It is quiet prevalent in urban settings as well. Rabe & van Staden (1997) realise that there is an increasing acceptance of traditional medicine as an alternative form of health care. The challenge is how we tap the knowledge about these medicinal plants so that the medicines are used less dangerously and that the knowledge is documented for future generations. It is also envisaged that such knowledge will enable the conservation of such plants. The world over, the importance of conservation of

resources is always highlighted. The knowledge about natural resources and their sustainable use is thus increasingly becoming important.

McGaw, Jager & van Staden (2000) observed that in several rural areas in South Africa a wide variety of plants are used to treat common ailments such as diarrhoea and intestinal parasites. It is estimated that between 12 and 15 million South Africans use traditional medicinal plants drawn from about 700 different plant species. In several developing countries, traditional medicines are part of primary health care (Hamilton, 2003). One of the strategies of the implementation of primary health care could be a multidisciplinary team approach where the integration of indigenous knowledge and modern health care should take place. For science educators, the important aspect is how to obtain the knowledge about these traditional medicinal plants and consequently incorporate it into the classroom for posterity. Lawson (1978) observed that in any culture there is some knowledge which is too valuable for its transmission to the next generation to be left to chance. Such knowledge as in the case of herbal plants could be made part of the school curricula. Such indigenous knowledge is the focus of my study.

In both South Africa and Zimbabwe, the use of traditional medicines is sometimes viewed with some scepticism. This may be due to the secret and mystical nature with which knowledge about the plants is viewed or the general perceptions that people have about the use of the medicines. A person who uses traditional medicines could be labelled, in the Shona culture- '*ane mushonga'* translated literally it means, 'he has medicines'. The implication is that it is bad to have such medicines. It is ironic that such 'bad' medicine is so apparently widely used. Indigenous knowledge is sometimes perceived as unscientific and based on superstitious beliefs. For many who have been taught to value western science and/or to be Christians this may cause moral dilemmas. Fako & Linn (1994,) note that traditional medicine and medicinal herbs including witchcraft is seen as bad and primitive. Growing up, I noticed that possession of medicinal herbs when one is not a recognised traditional healer would warrant the '*muroyi*' (witch) label amongst the Shona leading to one being isolated from the community and ridiculed. However, many researchers including van Wyk (1998) have carried out studies that have confirmed the presence

of active ingredients in most medicinal plants used by herbal practitioners and traditional healers. The question is to what extent is the knowledge about these traditional medicines important? This question will now be addressed in the following section.

2.3 The importance of IKS in Southern Africa

In an article in the *Saturday Star* (April 13, 2013) the current minister of water and environmental affairs in South Africa Edna Molewa stated that South Africa has a rich natural resource base and is ranked in the world's top three most bio-diverse countries. Many people rely on these natural resources for food, shelter and medicine. Molewa further added that protecting the traditional knowledge of the medicinal values of plant species is a key part of the South African government's sustainable use policy. Charles Perry of the Medical Research Council stated that South Africa has rich knowledge systems and biodiversity that has not been explored and those medicines from natural products treat 90% of human diseases (*Mail & Guardian* June 25, 2013. In the same article, the current minister of Science and Technology in South Africa, Derek Hanekom, is worried that indigenous products and traditional medicines were not sufficiently appreciated and there is a need to extract "value" from indigenous knowledge as in other countries like China. Richter (2003) notes that in the absence of a biomedical cure for AIDS and where a number of developing countries have not been able to provide anti-retroviral medication or adequate health care to those living with HIV and AIDS, a number of traditional healers have recognised the treatment of people living with HIV and AIDS as a lucrative opportunity. The AIDS epidemic forces people to renew their interest in these principles, both because of the overwhelming need for solutions and also because of the need to seek diverse solutions that are embedded in cultural and environmental contexts (Mbatha, 2012). This could be achieved through integrating such indigenously acquired knowledge into the school system.

2.4 IKS and School Science

2.4.1 The South African experience

In South Africa, the integration of school science and indigenous knowledge has been advocated for in recent years (Ogunniyi, 2010; Vhurumuku & Mokeleche, 2009). There is a great challenge to produce a national heritage and identity that transcends the colour and cultural lines. Amongst the advocates are Odora Hoppers (2002) who believes that IKS represents both a national heritage and a national resource that should be protected, promoted, developed and, where appropriate, conserved. Ogunniyi as early as 1988 argued for accommodation of the traditional worldview as opposed to *assimilation* into western science. The call is therefore for a symbiotic relationship between western science and indigenous knowledge systems. Science students' learning and engagement have been strongly connected to effective teaching practices that support the students' cultural capital and identity (Rofe, 2013). Ogunniyi (1995 p. 818), asserts that "a knowledge of what students and teachers bring to class is critical in situating the teaching-learning process within a meaningful context". My study sought to find out the knowledge that teachers and students have about traditional medicinal plants and their attitudes to this knowledge being brought into the classroom.

The importance of differentiating between knowledge and beliefs cannot, however, be overemphasised. Bruce Lewenstein, a sociologist at Cornell University, agrees that knowledge and belief are not the same and it would not be -"intellectually honest"- to pretend that they are (*Science*, vol 333, July 2011). Cameron (2007) suggests that IKS consists of three categories:

1. Indigenous knowledge which has science embedded in it.
2. Indigenous knowledge considered as traditional folklore.
3. Indigenous knowledge related to the spirit world.

Of the three categories the indigenous knowledge with science embedded is of importance to science curriculum developers. The aspect of belief would belong to category 2 in this model and is outside the scope of this study. The categories mentioned above can be illustrated in the figure below:

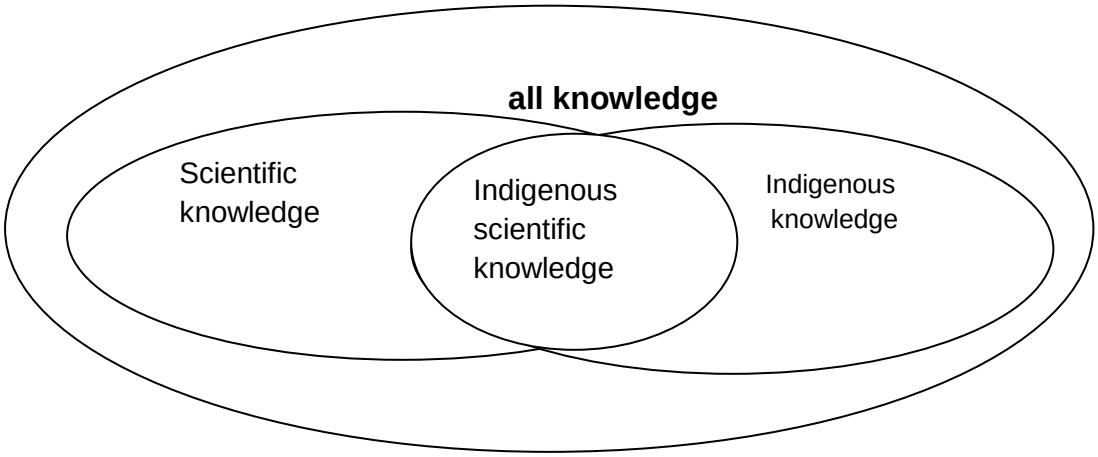


Fig 1: IKS and science as intersecting domains (adapted from Cameron, 2010)

The three categories are also an acknowledgement that not all indigenous knowledge is scientific. The intersecting concepts between indigenous knowledge and school science need investigation within the context of identifying relevant science in the indigenous knowledge. As it stands, the examples of IKS stated in curriculum documents are either vague or insufficient. It is my contention that knowledge about traditional medicinal plants is a potential school science content area that has relevance amongst the majority of students.

In a study to determine teachers' perceptions and uses of indigenous knowledge systems in the classroom, Naidoo (2002) found there were numerous instances where African beliefs and Western Science are contradictory. He also discovered that teachers felt strongly that they should not be judgmental or discard beliefs that were "impacting negatively" (2002 p. 16) on the lesson. Some culture-based opinions tend to counter scientific explanations. For example the belief that lightning can actually be 'created' by a human being defies the western scientific explanation. Hence there is need for culturally sensitive instruction. By undertaking this research I hope to be able to develop examples of culturally sensitive pedagogies. Teachers need to make judicious choices between their indigenous knowledge and conventional science when the need arises. The question is how can this be achieved? One way which has been proposed by scholars is the use of argumentation pedagogies.

Argumentation is defined as “the act of forming reasons, making inductions, drawing conclusions, and applying them to the case in discussion” (Merrian Webster encyclopedia). Argumentation is a form of discourse that may be utilized in science classrooms in order to challenge and refute explanations for particular phenomena. Toulmin’s Argumentation pattern (TAP) is a tool that can be utilized to trace the quantity and quality of argumentation in science discourse. TAP illustrates the nature of an argument through claims, data, warrants, backings and rebuttals. However the difficulty is in distinguishing what counts as a claim, data, warrant or backing. A schematic representation of TAP is outlined below.

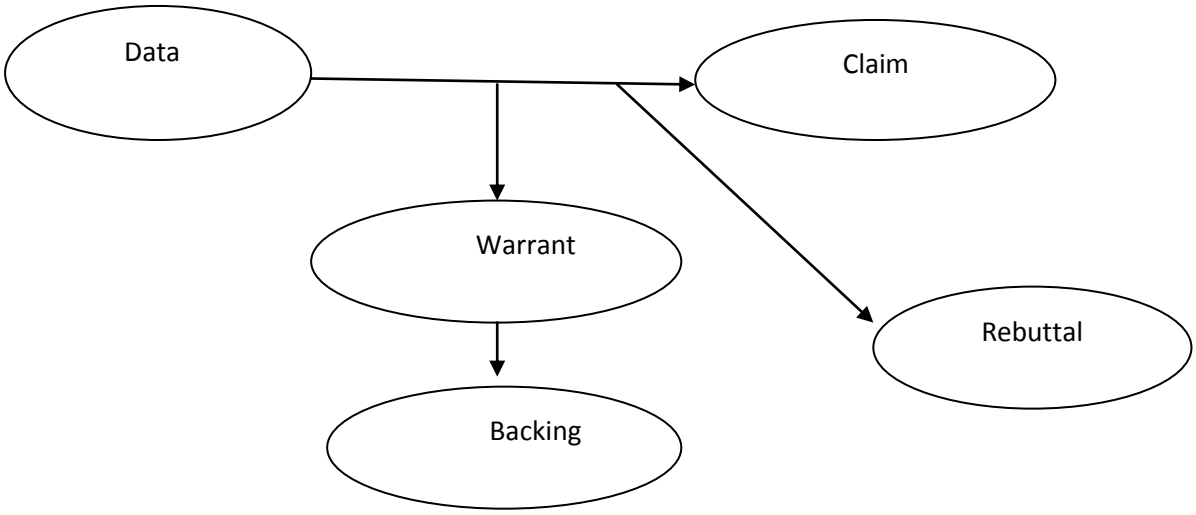


Fig 2: Toulmin’s argumentation pattern (TAP) adapted from Toulmin, 1958

According to Toulmin a claim is an assertion put forward for general acceptance. A claim must have data that supports it. Warrants provide the link between the data and the claim**.** Backings strengthen the warrants whereas rebuttals point to the circumstances under which the claim would not hold true. TAP can be used to analyse the level of argumentation. Traditional medicines are used for different reasons by different cultures. Hence the learners’ views about the uses of a certain traditional medicinal plant must all be accommodated.

The Contiguity Argumentation Theory (CAT) proposed by Ogunniyi (1997) explains the mechanism by which conflicts arising from opposing views (for example western science and IKS) are resolved. He suggests that such views may be resolved

through accommodation, integrative reconciliation and adaptation. The views may interact, overlap or conflict with each other hence an integration of the views through a larger synergistic conception is needed (Ogunniyi, 1997). The level of emotions that are aroused within the participants of an argument gives the nature of the views or ideas in the minds of the participants. CAT recognizes five categories of these levels which are: dominant; suppressed; assimilated; emergent; and equipollent (Ogunniyi, 2007). The fate of the ideas or views about western science or IKS concepts is often determined by the levels of the emotional arousal experienced by the participant. Some of these ideas may dominate hence be accorded supremacy or they may be suppressed, assimilated or considered to be at par with the conflicting ideas (equipollent). The question that still remains is how can the integration be best achieved? Several scholars have proposed models for the integration. One scholar is Ng'etich and his views will now be discussed.

Ng'etich (1996) proposed a model of integration of indigenous knowledge and western science. He identified three categories of integration – integration of one thing *into* another, integration of one thing *with* another and integration of one thing *and* another.

Table 1: Ng'etich's integration model

Integration form	**symbolic representation**	**description of strategy**
IKS *into* Western science	IKS → western science	unidirectional
IKS *with* western science	IKS ↔ western science	bi-directional
IKS *and* western science	IKS — western science	non-directional

Integration *into* supposes that IKS – (the integree) is a subset of western science the (integrator). It could suggest that IKS is less valuable and less useful than western science. Integration *with* supposes that there is equality between the two systems hence they are equally important and useful. Integration *and* is not judgemental about the relative importance of these two systems. The issue therefore is not of abandonment of one system and replacement by another, but one of addition, so that the earlier belief and the western scientific belief co-exist. The learner's task is to

learn the scientific concepts together with their indigenous beliefs, and to become clear about when it is appropriate to apply one belief or the other (Gunstone & White, 2000). According to Ogunniyi (2007), when two cultures or systems of thought meet, co-existence can best be found through conceptual appropriation, accommodation, integrative reconciliation, and adaptability.

In South Africa, it appears that some teachers have a positive attitude towards IKS and science learning but do not translate this belief into action (Naidoo, 2002). Therefore they seem to opt for the integration of IKS *with* western science instead integration *into* as would be expected given their colonialism background. For some educators, western science remains the valued and most useful knowledge which is the yardstick for measuring other forms of knowledge (Naidoo, 2002). This is expected as there appears to be no consensus on what it is that should be done to assist teachers and learners to achieve full science/IKS integration (Onwu and Ogunniyi, 2005).

Onwu and Ogunniyi (2005) conducted a study to assess teachers' knowledge and views about the nature of science (NOS) and IKS and elicit ideas on how to integrate NOS and IKS in the science classroom. The underlying assumption was that in order for integration to be feasible, teachers must have adequate understanding of the two thought systems. The findings of their study suggest that teachers' current understanding of IKS and NOS are inadequate. This is in line with findings reported in other studies (Ogunniyi, 2000). If integration is to be achieved then there is a need to improve teachers' knowledge and understanding of NOS and IKS. The question is, in view of the conflicting assumptions on which science and the indigenous knowledge systems are based; how can the teacher help learners attain some sort of cognitive harmony or equilibrium as far as the two distinct knowledge systems are concerned? It is therefore critical from a constructivist perspective to first explore teachers' present notions of the two thoughts systems (Ogunniyi, 2007). By investigating the attitudes of teachers and learners, I intend fulfilling this requirement.

Ogunniyi (2000) investigated the effect of an in-service course on raising teachers' awareness about integrating science and IKS. The findings showed a change in

teachers' practices. Teachers tended to have a "more sympathetic view of IKS" (2006: 1) and were more sensitive in their interactions with learners from indigenous cultures. This could mean that there is a need for more in-service training for practicing teachers and probably relevant courses for pre-service teachers to raise awareness on the importance of IKS. One goal of my research is to find out and to compare the attitudes of learners and teachers. This may help authorities in making decisions on whether such in-service trainings would be necessary, especially where a dissonance in attitudes could create conflicts.

2.4.2 The Zimbabwean experience

Shumba (1999), observed that, in Zimbabwe, a gap exists between indigenous cultural beliefs and the worldview that western science education seeks to develop. It is common to find Zimbabweans relying on traditional customs and practices especially in times of crises. The crises usually are during times of serious illness and western medicines have not successfully helped to treat the illness. In some instances where western medicines have successfully treated an illness the traditionalist may still need to consult a spirit medium to find out why the illness afflicted them. These practices reflect that Zimbabweans, like other Africans have culturally embedded knowledge that they fall back to despite westernisation. This study seems to assume that teachers' worldview is reflected in their attitudes towards IKS integration into science curricula. Shumba (1999) investigated the extent to which some Zimbabwean science teachers are oriented toward traditional culture and how this orientation is related to their instructional ideology preferences. He found that in the sample of science teachers, there was a consistently low orientation toward the dimensions of indigenous Zimbabwean culture hence a non-inquiry instructional ideology. He attributed this to the long years of formal and western education received by the teachers. This may reflect a general trend in Southern Africa since westernisation tends to alienate people from their cultural values. Such attitude shifts away from one's traditions gradually results in an erosion of a society's traditional practices. It is therefore important that such potentially valuable practices be preserved. A starting point could be an investigation of what knowledge is actually present hence the focus of my study.

Mutandwa and Gadzirayi (2007) argue that IKS covers several components of human experiences including agriculture, ethno-botany, medicine, climatology, engineering, politics, economics and sociology. They acknowledge the existence of 'science' in IKS. They further recognise that in Zimbabwe the strong link between IKS and the custodians -mainly a society's elders- is found in agriculture where both technical (which is predominantly western) and traditional techniques are used in conjunction. According to their view IKS should be taken in its holistic nature without having to isolate its components.

Kazembe and Nyanhi (2010) sought to investigate the attitudes and perceptions of teachers and learners towards integration of science and indigenous knowledge and how they compare. Their study investigated the relationship between students' and teachers' enacted worldviews and the teaching and learning of chemistry at a school in Harare. The schools' setting, in the high density areas of Harare (Zimbabwe), is typical of the township setting in South Africa where I undertook my research. Kazembe and Nyanhi (2010) based their research on the premise that the teaching of chemistry to "O" level students should be founded on what learners already know and the source of that knowledge. Their epistemological associations which define their worldviews must therefore be investigated and taken into account as these inform the teacher of a suitable teaching strategy. This is the foregrounding argument for my study. Similarly, they claim that the worldviews of the teacher must also be investigated as this may influence their teaching. Kazembe and Nyanhi (2010) discovered that it seemed that the worldviews of teachers and students were not synchronous hence teachers were unable to effectively assist students to negotiate cultural borders. Hewson *et al. (*2009 p. 6) refers to this as a failure to resolve 'conceptual conflicts'. This lack of compatibility may be detrimental to effective teaching and learning. Therefore in my research I also compared the perceptions and attitudes of teachers and learners. Kazembe and Nyanhi (2010) concluded that the religious and cultural view that the learners brought into the classroom did not have much influence on the teaching of O-level chemistry at this school. This is rather unexpected considering that culture strongly influences the prior knowledge that teachers and learners bring into class according to (Hewson *etal,* 2009). Recognition of prior knowledge is a tenet of constructivism which is advocated for in C2005, RNCS and CAPS which has already been pioneered in

grades 10 and 11 at secondary level in South Africa. My research investigated the prior knowledge that learners and teachers have about traditional medicinal plants hence constructivism is one of the theoretical underpinnings.

2.5 Constructivism

Constructivism as a theory of learning and development replaced some of the ideas held by behaviourists such as Skinner and Pavlov. The theory acknowledges that a child in the classroom is no *tabula rasa* or blank slate waiting to be 'filled' with knowledge. Their central idea is that new ideas are built on previously acquired ideas through individual mental construction processes. Piaget is considered as the 'father' of constructivism. The mental construction processes, if effectively undertaken, will be reflected in the attitudes of the learner which my research sought to investigate.

2.5.1 Constructivism and learning

The cognitive theorists focus on the individual as a unit of analysis and that knowledge is acquired through the construction and restructuring of concepts (schema). Piaget (1964), an advocate of constructivism, argues that learning is provoked by situations encountered during the physical and cognitive development of the child. He sees the idea of an 'operation' being the - "essence of knowledge"-. An operation is the interaction that a child has with an object in order for them to know or make sense of the object. Learners are therefore active participants in problem solving and critical thinking and their learning is tied to their environmental upbringing. In the context of my study the students' environment is the source of indigenous knowledge. The influence of the society and a learners' situation at home, are either ignored by the teacher, or are seen as a means for enabling the acquisition of individual knowledge. Hence the focus is on the individual's personal construction of knowledge.

Piaget identified four stages of knowledge development namely sensory-motor; preoperational; concrete operational and formal operational. A child will proceed to the next stage of development having acquired knowledge from the preceding stage; hence knowledge is built up from prior existing knowledge. Knowledge acquisition

involves reorganisation of prior knowledge through assimilation or integration and accommodation which leads to the coordination of the knowledge through self-regulation or equilibration. Therefore teachers must not teach beyond a learner's stage. They must progress from the known to the unknown and must not introduce complex concepts before laying a good foundation for their acquisition by the learner. Learners should be given opportunities to construct knowledge through their own personal experiences. This implies that teachers must structure activities that engage learners in critical thinking and applications of logic in order for them to derive their own conjectures and justifications (discovery approach) especially in tasks with multiple solutions. This can only be possible if teachers are aware of the prior knowledge that the learners have. The purpose of my research was to investigate the prior knowledge that learners have about traditional medicinal plant use.

2.5.2 Radical Constructivism

One scholar, who concurred with Piaget's concept of 'operation', is von Glasersfeld. He believed that it is ideal to have first-hand interaction with the phenomena that we seek to understand (In Tobin, 2007). Von Glasersfeld advocated a radical approach to constructivism in which he asserts that our perceptions are a version of the actual reality shaped by our mental functions, understanding and experiences. He further notes that experiences are inherently subjective and the subjectivity of these experiences implies that whatever content is to be learned is related to the epistemology of the learner.

2.5.3 Constructivism and prior knowledge

A learners prior knowledge including indigenous knowledge is specific to every learner hence every learner's perceptions must be acknowledged. It is important to identify and possibly document such prior knowledge which is peculiar to each learner. The feasibility of this in classrooms which are content and exam driven is questionable. Teachers should therefore expect different or even contrasting views and must carefully accommodate them especially in teaching socio-scientific concepts in order to limit controversial issues that may deter progress in class. Radical constructivism was seen by Taylor as quoted in Tobin (2007) to be an essential tool in decreasing the hegemony of western worldview.

The challenge that emanates from acknowledging prior knowledge that a learner has acquired, is to address errors that may abound in the prior knowledge. These misconceptions or alternative conceptions may produce a systematic pattern of errors. These alternative conceptions may therefore be 'faulty' extensions of prior knowledge that are central to development and they need to be incorporated into teaching and learning and not necessarily ignored. Hewson (1983), notes that some students often hold conceptions which are at variance with the scientifically acceptable conceptions even after formal instruction. Teachers must therefore take cognisance of learners' conceptions and these 'alternative conceptions' in facilitating learner development. It is important for them to discuss the wrong answers in order to obtain the underlying erroneous principle and correct it. This may be difficult as far as traditional medicines are concerned since some teachers, as reflected in this study are not as knowledgeable about the medicines as the learners. Nesher (1987) rightly observes that teachers, nevertheless, rarely do this especially when learners get the 'right' answers but for the wrong reasons. However, alternative conceptions might impede further learning. Some learners generally, hold onto what they have learnt from a 'trusted' teacher, hence hold on to erroneous conceptions even though correct information is given. This may be observed in co-teaching where the learner is taught by different teachers with different subject matter knowledge. IKS has a great deal of similarities with constructivism which tells us that there cannot be a perfect method for teaching. Rather, in the case of science and technology, all knowledge must be understood as depending on the society, gender and race of the individuals sharing the knowledge. These factors determine what is paid attention to and how the knowledge is interpreted (Montecinos, 1995: 297). The learner's social knowledge therefore needs to be integrated with what is otherwise regarded as mainstream, academic knowledge.

It is necessary that teachers acquire relevant knowledge on IKS in order for effective science- IKS curriculum materials to be developed. A starting point could be an investigation of the knowledge already possessed by teacher and learners from their societies, which is the focus of my research. The development of such knowledge passed from generation to generation in any society is described by socio-cultural cognitive theorists as social constructivism.

2.5.4 Social Constructivism and IKS

The socio-cultural perspective emphasises the relationship between society, culture and the individual in learning and development. Odora Hoppers (2001) defines IKS as:

> "..those systems of knowledge in philosophy, science, technology, astronomy, education, mathematics, engineering etc that are grounded in the total cultural heritage of a nation or society, and maintained by communities over centuries" (2001: 10).

The basic tenet of social constructivism is that such knowledge, as stated by Odora Hoppers, is mostly obtained through the experiences and interactions that a child has with their social environment as they are growing up. In the constructivist sense it is important to find out what knowledge the child already has as this knowledge forms the foundation for further construction of knowledge. It is on this basis that my research focuses on the knowledge that learners possess about traditional medicinal plants.

Social constructivism is a theory of learning that recognises the differences in the worldviews of western science and traditional cultures (Cameron, 2007). Thus, the focus is on learner- teacher interaction or the dyad. Such a unit may consist of two people - a learner and one other, a more able peer, a teacher, mentor or parent. Through the interaction of these two, meaning is socially constructed and knowledge is created. In this scenario, the teacher and learner are seen as equal partners in meaning making. Consciousness, in other words, is socially constructed. The ideas of Vygotsky still hold sway among educationalists, because the system he proposes takes cognisance of the social as well as the cultural. Vygotsky's insistence on the examination of pedagogy in context means that a child's development cannot be understood by a study of the individual only. We must also examine the external social world in which that individual life has developed.

This focus on the learner in their social context makes it necessary that whatever the learner is to be taught must be relevant to the learners' life. As such the immediate society has a crucial role to play. As an African myself, I have observed that a child's upbringing, in an African setting, is not the sole responsibility of the nuclear family

but rather the whole community. The community is involved in imparting the necessary life skills most of which are based on indigenous knowledge systems. This is vividly espoused in the rural African set-up for example in South Africa where the spirit of *ubuntu* is embraced. Keane and Malcolm (2003 p. 5) explain the concept of *ubuntu* as the "connectedness of self and other, community solidarity and human dignity". Ubuntu emphasises that: "I am because others are".

Vygotsky is a prominent socio-cultural theorist who believed that a unit of analysis for mental development had to take into account both social and individual aspects. This he termed "other regulation" and "self-regulation" respectively. Vygotsky (1978) appreciates the research done by various scholars to explain the relationship between development and learning but does not concur with some of their ideas. For example, Piaget's theory of cognitive development assumes that the process of child development is independent of learning. This point of view implies that cognitive development is always a prerequisite for learning. Vygotsky does not subscribe to this view as it precludes the notion that learning may play a role in the course of development and maturation of those functions activated in the course of learning. He also disagrees with theorists who believe that learning is completely and inseparably blended with maturation. He asserts that learning results in mental development hence development lags behind the learning process. He also acknowledges that the two- learning and development- are never accomplished to similar extents as in "the way a shadow follows the object that casts it" hence they are not mutually exclusive events. The key aspect here is that the human mind is mediated and this mediation takes place when human beings reflect on what they have learned. This permits connections and extensions of knowledge and skills for further learning hence facilitating development. This implies that for effective learner development, teachers need to encourage learners to work through challenging tasks to encourage thinking and self-evaluation. The teacher's role is essentially that of a mediator of the learning process.

In order to highlight his line of thought, Vygotsky proposed that there are social origins to human consciousness and that learning and development are interrelated from the first day of a child's life. In this 'new' approach to explain the relationship between development and learning, he put forward the concept of the 'zone of proximal development'. In this concept, - he identifies two developmental levels

which are; *actual* development and *potential* development. In actual development he implies that tasks that a child can perform on their own are indicative of their mental development. In *potential* development he asserts that tasks that a child can perform with the assistance of peers or teacher are indicative of their stage of mental development. He defines the zone of proximal development as the distance between the actual development and the level of potential development. It is those functions 'that have not yet matured but are in the process of maturation'. It is therefore vital that teachers probe learners to encourage them into higher mental functions during their instruction in order to explore the concepts that are still maturing. This enables teachers to evaluate learner readiness to progress to higher grades. Progression into higher levels should therefore take into account what a learner already knows. In my research I investigate what learners already know about traditional medicinal plants as a basis for further curriculum interventions.

In the 'general law of cultural development', Vygotsky proposes that mental functions appear initially in an external form because they are social processes. He envisages that development, in this regard cultural development, first appears on the social plane –the inter-psychological and then within oneself the intra-psychological. He therefore concurs with Piaget in that they both view internalization being a result of activities performed on the external plane (social environment) being executed on an internal plane (mental processes) (Werstch, 1985). According to Vygotsky (1978) 'the most fundamental concept of socio-cultural theory is that the human mind is mediated. Mediation takes place as long as human beings have an opportunity to consider what they are doing or what they have just learned. This permits learners to connect and extend their knowledge and skills for further learning which may affect our beliefs, views of the world, identity, and cultural and social awareness. It is important to investigate what learners already know in order for the knowledge to be extended.

2.6 Cultural Border crossing

The theory of cultural border-crossing, as explained by Phelan, Davidson & Cao (1991), postulates that learners have a particular world view based on their cultural values and belief systems. When these learners are exposed to the scientific

worldview in the classrooms they may experience ‘conceptual conflicts’ as they tend to subconsciously hold on to their traditional beliefs (Fakudze & Rollnick, 2008). According to Hewson, Javu & Holtman (2009) the teaching strategies employed by teachers must take into cognisance what the learners already know and the source of such knowledge in order to avoid these conceptual conflicts. Cognitive dissonance or conceptual conflicts refer to the ‘confusion’ or misunderstanding which results from the presentation of a new concept or approach which is in conflict with existing concepts, attitudes or beliefs. These conceptual conflicts also arise when learners try to learn concepts from a different culture to theirs and the conflicts may impede learning. Aikenhead (1996) argues that the role of the teacher is to facilitate smooth transition between the cultures i.e. the western view of science versus, in this case study, traditional African science which are viewed as cultures in their own right. The level of ease or difficulty of border crossing has implications for learning as the transition may be “hazardous” or even “insurmountable” (Phelan, Davidson & Cao, 1991). Aikenhead (1996) identified four types of transitions:

i) Smooth transitions

ii) Managed transitions

iii) Hazardous transitions

iv) and impossible transitions

Smooth transitions occur when there is very little conflict between the two worldviews. The two worlds are experienced to be in general harmony and could be seen as congruent. Managed transitions occur when differences exist between the worldviews but with the assistance of teachers, some learners manage to resolve the conflicts and adapt to the culture for example of western science from a religious or traditional worldview. Hazardous transitions are often a result of wide differences between the two worldviews, as such, conflicts are prevalent. Learners generally struggle to accommodate the western science culture hence may perform poorly in school science. Impossible transitions represent a high level of discord between the worldviews. Learners experiencing this feel discouraged when participating in school science. Aikenhead further linked the different transitions to the type categories of

students as identified by Costa (in Aikenhead, 1996). The table below illustrates the links between the type of border crossing and type of student (Cameron, 2007).

Table 2: Types of border crossing and type of student. Adapted from Cameron (2007).

Type of student (according to Costa, 1995)	**Characteristics of student (according to Costa)**	**Type of border crossing (Phelan et al., 1991in Aikenhead 1996)**
"Potential Scientist"	Enjoyed challenges of subject matter. Borders almost invisible	Smooth
"Other Smart Kids"	Few express any sense of science being a foreign culture.	Managed
"I don't know Students"	Have difficulty in finding a connection with school science but learn to cope.	Hazardous
"Outsiders"	Students whose life-worlds are discordant with school science and are discouraged from doing science	Impossible
"inside outsiders"	Overt discrimination at school level leads to students not crossing borders.	Impossible

Smooth transitions may be facilitated if the curriculum openly acknowledges the existence of the different cultures and worldviews about scientific concepts. An impediment could possibly be identifying *what* knowledge is best included in the science curricula and how a different worldview may be accommodated (Keane, 2005). The question of relevant science education remains the key factor for curriculum design (Rollnick, 1998b cited in Keane 2005). The challenge for teachers

is to ensure that transitions from one view to the next must be smooth. By investigating the attitudes of learners and teachers towards integration of knowledge about traditional plant medicines into the science curriculum, potential cognitive conflicts could be identified and this may help teachers to help learners to resolve the conflicts. An alternative explanation of how learning could occur in learners faced with the two conflicting worldviews was put forward by Jegede (1995) and his theory of collateral learning will now be described.

2.7 Collateral Learning

Jegede presented his theory of 'collateral' learning to the Southern African Association for Research in Mathematics and Science Education conference (SAARMSE) in Cape Town in 1995 where he was a keynote plenary speaker. In this theory of collateral learning, Jegede (1997) proposes that children entering the science classroom for the first time are exposed to potential conflicts and dilemmas. Jegede's theory exposes the link between a learners' prior knowledge based on their context and their ability to integrate and appropriate new knowledge by showing different behaviours and holding different ideas in different contexts. This implies that learners have the potential to live a dual life- one as a traditionalist at home and the other as a western science learner at school (Khupe, 2012). I personally testify to such an existence having grown up in a family that embraced both traditional ways (in the rural areas) and western lifestyle (in the urban area). I managed to let the two worldviews co-exist in me by adopting a 'being in Rome and behaving like the Romans' character. Thus Jegede (1997: 11) describes collateral learning as:

> "..the process whereby a learner in a non-western science classroom constructs, side by side, and with minimal interference and interaction, western and traditional meanings of a simple concept.."

Jegede (1998) identifies four levels of collateral learning:

- parallel collateral learning where students construct incompatible ideas from the two worlds in separate compartments in their mental schema
- simultaneous collateral learning where a student connects ideas from the two worlds at the same time

- dependent collateral learning where a student uses ideas from one worldview to challenge or understand the views from another
- and secured collateral learning where the learners resolve any conflict and convergence towards commonality is achieved.

Jegede and Aikenhead as cited in Fakudze and Ogunniyi (2003) claim that there is a relationship between:

- Smooth border crossing and parallel, secured or no collateral learning.
- Managed border crossing and parallel, simultaneous or secured collateral learning
- Hazardous border crossing and either dependent or simultaneous collateral learning
- Impossible border crossing and possibly collateral learning.

Collateral learning is apparently a practical way to achieve cognitive harmony between the two worldviews especially where the western science interpretation of a phenomenon are totally incompatible with the indigenous traditional explanation.

2.8 Summary

Some of the main research findings on IKS integration include advocates who emphasise aspects of redress and decolonising the mind (Odora Hoppers, 2002); those championing the use of indigenes research approaches and the de-Westernization of IKS paradigms (Smith, 1999; Mpofu, Mushayikwa, Otulaja, 2012; Mpofu, 2012); and those who propose greater awareness of alternative worldviews which is relevant to all learners (Keane, 2006; Malcolm, 2005). Other researchers call for critical appraisal of IKS and the need for reasoned dialogue in research, teacher training and classroom practice (Moyo, 2011; Webb, 2006). A need to be sensitive to teacher attitudes towards IKS (Moyo, 2011), a focus on ethno pedagogies and relevance (Keane & Malcolm, 2003), community input (Hewson, 2009)) and community-centred approach to at least some IKS modules (Keane); and specialising on healing (Hewson and Ogunniyi, 2011). The call for cultural relevance has also been advocated for earlier on by Makhurane (2000). The call to document and archive the IKS in various locations (Otulaja, Cameron and Msimanga, 2011)

requires support and could be the possible way forward to achieve full IKS-science integration.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

In this chapter the methodology employed is discussed. According to Burns and Grove (2003), methodology includes the design, setting, sample, methodological limitations, and the data collection and analysis techniques in a study. Henning (2004:36) describes methodology as a "coherent group of methods that complement one another and that have the ability to fit to deliver data and findings that will reflect the research question and suit the researcher purpose". Schwandt (1997) broadens the view of methodology to the theory of how inquiry should proceed that involves analysis of the principles and procedures in a particular field of enquiry. Schwandt (1997) further articulates that methodology incorporates the reasons behind and aspects that govern the use of particular methods. It can be gleaned from these definitions that research methodology refers to the various ways and guiding principles used when conducting research. It is made up of several interrelated components. This chapter is presented in sections which reflect these methodological aspects. These are guiding paradigm, the research design, research participation, data collection and procedures, data analysis and interpretation, presentation of findings, plausibility (authenticity) of findings and the research process. The reasons for the choices of these methodological aspects are provided and ethical considerations also discussed in line with the aim of the study. This study aimed to elicit the knowledge that learners and teachers at a township school in South Africa have about traditional medicinal plants and their attitudes towards the integration of such knowledge into the science curriculum. This methodology section therefore seeks to find answers to the research questions. These ask:

(i) What knowledge about traditional medicinal plants for common ailments do grade 9 teachers and learners have?

(ii) What are the participants' attitudes about integration of medicinal plant knowledge into the Natural Sciences curriculum?

(iii) How do the knowledge and attitudes of learners and teachers compare?

The paradigmatic considerations are discussed first in the ensuing section. This chapter is concluded by a brief summary.

3.1 The Qualitative paradigm used in this study

A paradigm maybe viewed as a set of ideas or belief systems that influence the mechanisms used by researchers when performing their investigations. This qualitative research employs a naturalistic approach that is context-specific and linked to a real life situation. In such a situation the researcher does not attempt to “manipulate the phenomenon of interest" (Patton, 2001: 39). Qualitative research may be defined as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss and Corbin, 1990: 17). Unlike quantitative researchers who seek causal determination, prediction, and generalization of findings, qualitative researchers search for deeper understanding of a phenomenon and use it to explain similar situations (Hoepfl, 1997). It is therefore imperative that the phenomena under investigation should unfold naturally. This was the case with this research as it was undertaken in a classroom setting which learners are accustomed to hence phenomena unfolded naturally. In this study qualitative data collection techniques were used to score the attitudes and the knowledge possessed. It was critical that learners do not get manipulated in any way since I needed to investigate their genuine attitudes.

3.2 Case Study design

The research is a case study of a small community of participants in a school in the Meadowlands township of Soweto. Anderson (1993) views case studies as being concerned with how and why things happen, allowing the investigation of what exactly is happening in a context and the differences between what was expected and what actually occurred. A case study is not intended as a study of the entire organization. Rather is intended to focus on a particular issue, feature or unit of analysis. A case study according to Hitchcock & Hughes (1995 p.321) “is not only rich in detail, it is used to develop conceptual categories or to illustrate, support or challenge existing assumptions that were held before the start of data collection”. The case study is research approach that investigates a few cases, and most often just one, in considerable depth (Opie, 2004). There is therefore a potential for rich data as it provides for detailed analysis. Opie (2004) further states that case studies are studies of particular individuals but they could also be of individuals participating in groups. My participants could be considered as individuals participating in groups

since they reside in Meadowlands – the location of the school under study. The research was thus bounded at the school in Meadowlands area. Cohen and Manion (1994) agree with this notion by stating that the case study researcher typically observes the characteristics of an individual unit. The case study also permits the investigation of a unit in limited time frames. It is these characteristics which make the case study design to be suitable for the problem under investigation in this study.

3.3 Context of study

I conducted this study in Meadowlands, a Soweto high density township in the city of Johannesburg in South Africa. The school is my place of work – a secondary girls only school in Meadowlands which I will title school G. In Meadowlands the use of traditional medicinal plants for curing several ailments appears to be widespread. I have noticed numerous traditional healers that one can identify by their regalia and other cultural artefacts. There may be other less noticeable healers as well especially the spirit mediums who serve as 'consultants' and not healers per se. There are also several clustered *muthi* (Zulu for medicines) shops with the more prominent one located at the main shopping centre – Meadowpoint. Some learners have reported having visited this shop for medicines when asked about reasons for being absent from school due to sickness and the requirement to supply a note from the clinic or doctor. Some have even claimed that the shop is their first port of call when they are sick. The fact that the learners knew about the existence of such a shop may suggest that they may have visited it hence have some knowledge and opinions about traditional medicines. The area is particularly multicultural with zones that demarcate particular cultural groups. The main cultures of the area are the Zulu, Tswana and Sotho. The learners attending the school are mainly from these cultures. Undertaking this study in this area would therefore be expected to yield substantially rich data and would be expected to enable myself as a science teacher in the area to contextualise my teaching. It is from such a context that my participants came from. I now discuss the participants in detail.

3.4 Ethics

Permission to conduct this research was first obtained from the Gauteng Department of Education after which the Wits University ethics committee also granted clearance. My school principal kindly consented to the research being done at the

school with consultation with the Johannesburg West District officials. The research participants all consented to participation and some consented to being interviewed even though a few were selected. The parents of the learners who participated in the research also gave consent since all the learners were under the age of eighteen.

3.5 Research participants

The research participants were 36 grade 9 learners and 10 senior phase Natural Science educators in secondary schools in Meadowlands. The 36 learners all constitute members of the class that I was teaching and they had given the necessary consent for participation. In convenience sampling it is imperative that the participants be "willing and available to be studied" (Creswell 2012 p.145). The 10 educators are cluster colleagues of which 5 are from the school that I teach at.

3.5.1 Teachers

The teachers possess a minimum of 5 years of experience in teaching Natural Sciences and possess a minimum of a diploma in education. Five are from neighbouring schools and the other five from my school. This minimised the problem of unreturned questionnaires hence may have improved validity of findings. The teachers are all black with two originating from Lesotho. Two teachers were selected for the interview based on their detailed responses to the questionnaire which reflected that they knew a lot about traditional medicines and were potentially willing to share this information with me.

3.5.2 Learners

36 grade 9 female learners doing Natural Sciences were requested to complete the questionnaire. These were my students from the one class I was teaching Natural Sciences and had all consented to participate. Consent was also received from their parents or guardians. The majority of the learners are above average performers. Their ages range from 14 to 17 years and were all black South Africans. From the 36 learners, 5 learners were selected for a group interview based on their responses from the questionnaire and if they had consented to be interviewed. The data collection methods will now be described.

3.5.3 The traditional healer

The traditional healer is a local herbalist who sells traditional medicines at a local *muthi* shop. He consented to participating in the research through permitting me to take photographs of his medicinal plants and the several not so formal discussions we had.

3.6 Data collection: Methods, tools and procedures

A multi-method approach that involved the use of five methods of data collection were employed namely a structured visual questionnaire for learners and teachers; an attitudes questionnaire also referred to as the ROSE type questionnaire; interviews for learners, teachers and the traditional healer; class discussions and observations of a classroom debate, a personal journal documenting the process and field observations and informal conversations. These five methods constitute a multiple methods approach to data collection.

Multiple methods involve the use of more than one procedure for data collection from the same group of participants. Multiple methods of data collection enable triangulation (Cohen and Manion, 1994) of the data. Triangulation is defined by Denzin (1978: 291) as "the combination of methods in the study of the same phenomena". Triangulation is thus a process of corroborating information obtained from research participants. It therefore improves accuracy of evidence and hence enhances credibility (Bouchard 1976). Engaging multiple methods, such as, observation, interviews and visuals may therefore lead to more valid, reliable and diverse viewpoints.

A structured pictorial questionnaire (also referred to as a visual test) with both open ended and closed ended questions was administered to learners as a 'test' to determine their prior knowledge about medicinal plants as they had not been 'taught' about them in class. The test was however not for assessment purposes and this was explained to the learners. To design the test, I visited the herbalist at the *muthi* shop at the main shopping centre. I received a very warm welcome especially after I introduced myself as a science teacher. Having explained my purpose for the visit I was given a tour of his 'lab' as he affectionately called the room in which he sorts out his medicines. He gave me consent and I collected five photographs of medicinal

plants that he considered ‘popular’. The herbalist expressed willingness to be asked about his plants, something I did not expect as I, like many of my high school mates, grew up with a belief that such knowledge was very private and a closely guarded secret. I used the photographs to compile the visual test that was given to both teachers and learners. The questions checked teachers’ and learners’ knowledge about the ‘popular’ plants and their attitudes regarding the effectiveness of these medicinal plants. I gave the participating teachers the same questionnaire to respond to but it was not in the form of a test but a ‘take home’ task to be filled in at their most convenient time. A focus group of 5 learners were also subjected to a group interview and two teachers were interviewed individually. I interviewed the learners as a group in order to encourage them to speak up as they would be freer to air their views in the presence of peers. If I had done one-one interviews, I anticipated them to be more shy and not feel free to air their views with the teacher. I also anticipated that more discussion would emerge as learners responded to each other and not only with me. I conducted the semi-structured interviews using a simple interview protocol. An interview protocol is a draft of the main questions to be asked and possible probes. I used an observational protocol to analyse the class debate. An observational protocol is a record of the qualitative information obtained at an observational site. Three methods of data collection used will now be discussed.

3.6.1 The visual questionnaire

Visual methods involve the use of photography, imagery or diagrammatic representations to investigate responses to phenomena or experiences. Visual methods can: provide an alternative to the hegemony of a word-and-number based questionnaires. In this research a pictorial questionnaire was developed as I wished students to see the medicinal plants as they would in the field or in the *muthi* shops.. Questionnaires are instruments that may be used to obtain data that lie within the minds of people (Leedy, 1989). It is ideal to use questionnaires to obtain data about the attitudes, feelings (Leedy, 1989) and perceptions that people have towards certain phenomena. Early critics of the photography-as-data approach argued that researchers generally lacked thorough knowledge of alternative methodologies and used photographs either as illustration or as flimsy support for their ideas.

The educators are cluster colleagues who are known personally by the researcher. The questionnaire, in this case the visual questionnaire, allows the researcher to gather information in a short space of time (Creswell, 2012). Structured questionnaires are important in eliciting specific responses from participants. The questionnaire had both open ended and closed ended questions. Open ended questions however encourage participants to elaborate more on their experiences and definitions (Creswell, 2012). This is true especially if it is well designed so as to give clear codes for the data. The way I structured the questions ensured that specific themes would emerge, in other words some key themes were preset.

The visual method's main disadvantage may be that of lack of picture clarity to the participants. To overcome this problem I gave participants other photographs other than those on the questionnaire in order to properly identify the plants. For the learners I also hand the pictures focused on a screen from a data projector. I also used other methods of data collection. Interviews as a data collection technique will now be discussed.

My research focused on the attitudes and perceptions that grade 9 learners and educators have towards the incorporation of knowledge about traditional medicines into the science curriculum. Pictures were used also to increase the interest of the learners. Furthermore photographs of plants were appropriate for dealing with information that is not easily presented in English and the plants may have different names in the different language groups of the learners. The visual questionnaire was also completed as part of a lesson during class time (see appendix 1).

3.6.2 The semi-structured Interview

According to Opie (2004) semi-structured interviews focus on a list of key themes or questions that the interviewer wants the respondent to address. The semi-structured interview does allow for the respondent to add new information (Opie, 2004) but this information should not override that which the interviewer set out to obtain. I conducted focus group interviews with 5 learners and individual interviews to the two educators as well as the traditional healer with whom I had other informal discussions. A focus group interview enabled me to collect the shared knowledge

among the five learners. They were selected on the basis of their detailed responses in the questionnaire which indicated they had reasonably thorough knowledge about medicinal plants. I considered the group interview to be more reliable. Reliability implies that information from an instrument is “stable and consistent” (Creswell 2012 p. 159). I allowed participants to use the language they were more flexible with and by chance all were Zulu speaking- a language that I understand better.

The greater reliability of the questionnaire compared to the interview may be owed to the fact that responses are written at the respondent’s own time and pace (Creswell, 2012). I did not have to be present when the participants filled in the questionnaire, but since this was during class time I was present. . The questionnaire however does not allow the researcher to probe interesting responses unlike the interview. In this research, I was able to probe for deeper clarity of responses on the target group that had consented to be interviewed as well as respond to the questionnaire. Semi-structured interviews were done using a simple interview protocol. An interview protocol is a draft of the main questions to be asked and possible probes. Given the sensitivity of the topic I was careful not to probe deeper than what participants were comfortable with sharing. I had to ensure that the interview does not end up being another debate as clearly learners had different opinions. I had to limit the time that each speaker had as learners continued to show interest in the discussion. An observational protocol was used to analyse the class debate.

3.6.3 Class Debate and Discussion

Observation is the gathering of information through the analysis of an event or phenomenon unfolding. Observations are a frequently used form of data collection (Creswell, 2012). Observations enable the researcher to record information from its production site since it occurs at a particular setting. In this research I took a changing observational role (Creswell, 2012). My role during the debate was more to that of an external observer taking down notes and recording the conversations to obtain data from the interactions of the learners during the class debate. The topic of the debate was: traditional medicines are more effective than western medicines. As the class teacher I had to organize the class into two groups those opposing the topic on one side and those supporting on the other. Adjudicators were also appointed and I assumed the role of a nonparticipant observer as the debate began.

However when tensions rose during the debate I had to intervene and periodically pass a comment especially with regards to sensitivity and respect for fellow speakers' opinions. Some learners were not conversing well in English and frequently spoke in vernacular to make their points. The adjudicators accepted this. At the end of the debate I had to summarise the arguments from both sides referring to the notes drafted during the debate. The table below summarises the sources of data and the research questions that were subsequently addressed.

Table 3: Data sources and corresponding research questions addressed.

Research question(RQ)	Data Source	Appendix
RQ1. What knowledge about a selection of traditional medicines for treating common ailments do Grade 9 Natural Sciences teachers and learners have?	• Visual questionnaire • traditional healer • interview- learners and teachers	Appendix 1 Appendix 3- interview protocol
RQ2. What are a group of South Africa Grade 9 teachers' and learners' attitudes about integration of medicinal plant knowledge into the school science curriculum?	• Class debate • Attitudes questionnaire (Rose-type questionnaire) • Interviews-learners and teachers • follow up interviews with learners (now in grade 10)	Appendix 2 Appendix 3- sample interview questions
RQ3. How do the knowledge and attitudes of teachers and learners compare?	• findings check follow up discussions	Appendix 4 – graph 1.

The data so obtained were analysed as outlined in the proceeding text.

3.7 Data Analysis and Interpretation

Analysis of data included content analysis. Content analysis is a technique for systematically examining and describing written or spoken information (Cohen, 2007). Both conceptual analysis and relational analysis methodologies were employed to scrutinize the data. In conceptual analysis the number of times certain words appear in a text or communication is determined. Relational analysis examines the relationships among the words or concepts in the text in this case the interview transcripts and the field notes. In doing the content analysis the transcripts were broken down into themes that mainly related to the attitudes that participants had towards integration of knowledge about traditional medicinal plants into the science curriculum. After themes had been obtained the data was coded and categorized. Three categorize emerged- those in favour of integration of medicinal plant knowledge into the science curriculum, those who oppose it and those who were indifferent. Coded data were clustered and then categorized to identify themes and patterns. The data obtained from the class debates were qualitatively analyzed.

3.8 Presentation of findings

The data were presented using descriptive statistics like frequency counts especially in determining the knowledge that participants had for the various medicinal plants. This information was tabulated and where appropriate bar graphs were used to represent the data. Excerpts from the field notes generated during the class debate and interviews were also be presented. The excerpts are specifically those that answered my research questions.

3.9 Plausibility of findings

Plausibility relates to the degree to which the findings of the research are acceptable. It relates to the transferability and credibility hence validity of the findings. Opie (2004) describes transferability as the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings. From the qualitative nature of this study, transferability is primarily the responsibility of the science educators in transferring the findings of this study to their classrooms and other related situations. Golafshani (2003) describes credibility in research, as the

criteria that involve establishing if results of qualitative research are that credible from the perspective of the participant in the research. Since from this perspective, this qualitative research is to elicit the knowledge and attitudes about traditional medicinal plants of science educators and learners, it is the participants who can legitimately judge the credibility of the results.

3.10 Summary

The chapter has exposed that the methodology is made up of several interrelated components aimed at answering the research questions. The essential feature of any methodology is its ability to clearly expose the mechanisms by which the research questions will be answered. The multiple methods of data collection employed in this research enable a conclusion to be derived and if need be, further investigation suggested. The coherent nature of the various components that constitute the methodology has also been described. This nature will be reflected in the ensuing section which details the findings of the research.

CHAPTER 4: RESEARCH FINDINGS

4.0 Introduction

In this chapter I report on the data that were collected and analysed. Data were obtained from the student class activities which were: the visual questionnaire, the attitudes questionnaire, the class debate and class discussion and the follow up discussions. The students, teachers and traditional healer were also interviewed. The data sources were considered from the two main groups of respondents: the learners and teachers. The traditional healer, though not a main part of the study, assisted by allowing me to take photographs of the medicinal plants and served to corroborate the information obtained from learners and teachers. This was in order to verify the correctness of especially the names and uses of the traditional medicinal plants in the visual questionnaire. Thematic analysis was used to categorise the reasons that respondents put forward to support or oppose integration of knowledge about traditional medicinal plants into the science curriculum.

4.1 The visual questionnaire-class activity (grade 9)

The table below summarises the responses obtained from the learners and teachers on the names and uses of the five indigenous medicinal plants whose pictures they were given in the questionnaire.

Table 4: Responses of participants and their tribes

Participant	TRIBE	KNOWLEDGE									
		Plant 1 *Drimia robusta* Sekanama(tswana) Indongana, zibomvana, isiklenama(zulu)		**Plant 2** African potato *Hypoxis* hemerocallidea Inkomfe (zulu)		**Plant 3** Everlastings *Helichrysum species* imphepho		**Plant 4** Cheesewood Umfusamvu(zulu) Kgalagangwe(n. sotho) Umkhwenkhwe(xhosa)		**Plant 5** Aloe bitter *Aloe ferox* Umhlaba (z,x,s)	
		NAME	**USE**	**NAME**	**USE**	**NAME**	**USE**	**NAME**	**USE**	**NAME**	**USE**
BM002	**S. SOTHO**	N	N	Y	Y	Y	Y	N	N	Y	Y
BM009	**S. SOTHO**	Y	Y	Y	Y	Y	Y	N	N	Y	Y
BM013	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM027	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM029	**S. SOTHO**	Y	Y	Y	Y	Y	Y	N	N	Y	Y
BM031	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM034	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM035	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
TR002	**S. SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM023	**S. SOTHO**	Y	Y	N	N	Y	Y	N	N	Y	Y
BM018	**SHONA**	-	-	N	N	N	N	N	N	N	-
TR005	**SHONA**	N	N	N	N	N	N	N	N	N	N
TR007	**SHONA**	N	N	N	N	N	N	N	N	Y	-
TR008	**SHONA**	N	N	N	N	N	N	N	N	Y	Y
BM001	**SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM012	**SOTHO**	N	N	Y	Y	Y	Y	N	Y	Y	Y
BM015	**SOTHO**	N	N	N	N	Y	Y	N	Y	Y	Y
BM016	**SOTHO**	N	N	N	N	Y	Y	N	N	Y	Y
BM030	**SOTHO**	N	N	N	N	Y	Y	N	N	Y	-
BM003	**TSWANA**	N	N	N	N	Y	Y	N	N	Y	Y
BM006	**TSWANA**	-	-	N	N	Y	Y	N	N	Y	Y
BM007	**TSWANA**	N	N	N	N	Y	Y	N	Y	Y	Y
BM008	**TSWANA**	N	N	N	N	Y	Y	N	N	Y	Y
BM011	**TSWANA**	N	N	N	N	Y	Y	N	N	#	-
BM014	**TSWANA**	N	N	N	N	Y	Y	N	N	Y	Y
BM021	**TSWANA**	N	N	N	N	Y	Y	N	N	Y	Y
TR009	**TSWANA**	N	N	N	N	-	-	N	N	Y	Y
BM010	**VENDA**	N	N	N	N	Y	Y	N	N	N	N
TR001	**VENDA**	N	N	N	N	Y	Y	N	N	#	Y
TR006	**VENDA**	N	N	Y	Y	Y	Y	N	N	#	-
BM004	**ZULU**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
BM005	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
BM017	**ZULU**	N	N	N	N	Y	Y	Y	Y	Y	Y
BM019	**ZULU**	Y	Y	Y	Y	Y	Y	N	N	Y	Y
BM020	**ZULU**	N	N	N	N	Y	Y	Y	Y	Y	Y
BM022	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
BM024	**ZULU**	N	N	N	N	Y	Y	Y	Y	Y	Y
BM025	**ZULU**	Y	Y	Y	Y	Y	Y	N	N	Y	Y
BM026	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
BM032/038	**ZULU**	N	N	Y	Y	Y	Y	N	N	Y	Y
BM033	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
BM036	**ZULU**	Y	Y	Y	Y	Y	Y	N	N	Y	Y
TR003	**ZULU**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
TR004	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
TR010	**ZULU**	N	N	N	N	Y	Y	N	N	Y	Y
BM028/014 PENCIL	**ZULU***	N	N	N	N	-	-	N	N	#	-

KEY: Y – YES; N – NO; BLANK SPACE- NOT COMPLETED; # - ILLEGIBLE/ UNKNOWN WORD

CODES STARTING WITH BM (my initials) ARE FOR LEARNERS AND TR (acronym) FOR TEACHERS.

From the table seven out of thirty six learners had knowledge of the name of the first plant (drimia robusta-*sekanama*) and correctly stated the name. None of the learners used the Latin name (for any of the plants). A variety of uses were given and these uses tend to differ between the different tribes. The common uses stated were that the roots are used to 'clean' the body and cure stomach ailments. One learner stated that it is used when one is bloated. This is quite interesting as this was corroborated by the traditional healer who emphasised that the plant was used to strengthen the immune system hence prevent common stomach ailments. The herbalist also confirmed that these plants are used differently amongst the different tribes. This raises some concerns about the true efficacy of the medicines. Pharmacologically the plant is known to be an expectorant and a diuretic (Van Wyk, Van Oudtshoorn & Gericke, 2009). It is also known to cleanse the bladder and uterus (Xaba & Croeser, 2012). It appears that the uses that the learners know of are related to the pharmacological properties of the plant. Hence, for the seven learners who knew the uses it can be concluded that they have some knowledge about the plant's medicinal properties. Learners who knew the plant also indicated that the plant was effective in the treatment. This however cannot be said for the teachers. Only one of the ten teachers actually knew the plant and its medicinal use.

Both learners and teachers had better recognition of Plant two (African potato-*inkomfe/imbiza*) and its uses. Ten of the thirty six learners knew the name and some uses of this plant's tubers. Three of these learners identified the plant as the African potato whilst the seven used the vernacular names such as *imbiza. Imbiza* refers to the bitter drink prepared using the tubers and other herbs. The common uses are to 'clean' the blood (in isiZulu *kuhlambigazi*). One learner stated that the plant tubers cure "all illnesses". This is a reflection of the presumed potency of the plant's root tuber. Pharmacologically the plant is known to be anti-mutagenic and is cytotoxic to cancerous cells. It is used to treat dizziness and is given as a tonic to children (Van Wyk, Van Oudtshoorn & Gericke, 2009). Only two teachers managed to identify the plant and mentioned some uses. All learners who knew the name agreed that the plant was effective in treating ailments. One learner stated that the medicine is effective but:

> "*it is difficult when you look or drink it*"

It is not exactly clear what the learner meant but this could point out to the medicines being bitter and unpleasant to swallow hence when they look at them they have unpleasant feelings. It is interesting to note that relatively few learners recognised this plant and very few of the teachers. The plant has often been in the news as a potent treatment for HIV/AIDS and a Google search of African potato yields over 13 000 results. Indeed the plant is often available in grocery stores.

Plant three (everlastings- *imphepho*) was by far the most well known. Only one learner out of the thirty six failed to identify the plant. The learner is Shona and comes from Zimbabwe. The popularity of the plant is also reflected in the fact that of the ten teachers, six local teachers managed to name the plant and state its uses. Three of the teachers all Shona speaking and from Zimbabwe did not manage to state the name or uses of the plant. The common uses mentioned are to 'remove' bad or evil spirits and for 'communicating' with or 'calling' the ancestors. One learner stated that it can be used to treat '*leleta*' (thick phlegm or mucous in the mouth) in new born babies. This communication with the ancestors' aspect could be because the leaves of the plant are burnt as incense during traditional ceremonies especially amongst the Zulu tribe. It followed that most learners agreed that the plant was effective since it is always used in such ceremonies to communicate with the ancestors and one learner mentioned that babies are able to sleep well after 'smoking' (probably inhaling) *imphepho*. Pharmacologically the plant is anti-inflammatory and is used as a pain reliever (Van Wyk, Van Oudtshoorn & Gericke, 2009).

It was however noted that some learners seemed to be confused by the term 'effective' and probably took it to mean that the plant negatively affected someone. This was observed as one learner responded to the question:

> Question: *Do you think it is an effective medicine? Explain your answer*.
>
> Response: *"No, because many traditional healers use it to treat sick people".*

The response is contradictory and could imply that the learner did not comprehend the meaning of the term effective.

Plant four (cheesewood-*umfusamvu*) proved more difficult to identify with only four of the learners managing to identify the plant. Several learners thought the plant was

the African ginger. This could be due to the slight similarities between the cheesewood and the African ginger (as in the picture) that could easily confuse the learners. The uses stated were as a relief for colds and flu and one stated that it was used to relieve toothache and pains. The traditional healer corroborated this and mentioned that it was used for abdominal pains and fever. Pharmacologically the plant is an analgesic hence its pain relieving properties and it also has antibiotic properties (Van Wyk, Van Oudtshoorn, & Gericke, 2009). Only one of the ten teachers got the name and uses correct.

Plant five (Aloe bitter- *umhlaba*) was well recognised by thirty two of the thirty six learners. Two of the learners wrote the name illegibly. This could have been due to their inability to spell the name of the plant. It was interesting to note that most learners stated that they saw this plant in their homes or gardens. This could imply that this plant is widely used amongst the different tribes in South Africa. A wide variety of uses were stated including for relief of pains in the legs, 'high blood' (high blood pressure), colds and flu, tonsillitis, skin diseases (dark spots), cleaning the stomach and throat infections. All these uses were confirmed by the traditional healer who further added that it is a multipurpose herb. Pharmacologically the plant is considered to be a laxative and stimulant (Van Wyk, Van Oudtshoorn & Gericke, 2009). It increases peristalsis and water absorption. Eight of the ten teachers identified the plant. This highlights the popularity of the plant as most teachers managed to identify this one plant only. The plant appears to be well used across all cultures including the Shona of Zimbabwe who also identified and mentioned the uses of the plant. It was interesting to note that when the slide of this plant was shown from the data projector most learners smiled and made some gestures with their hands and commented with the words "Aah easy!" This showed that most learners were really familiar with the plant as was reflected also in their responses. It could also reflect the general enthusiasm that the learners had when performing the task. The table below summarises the findings:

Table 5: Summary of participants with knowledge of name

	learners	teachers
Plant 1	7 (19.4%)	1 (10%)
Plant 2	10 (27.8%)	2 (20%)
Plant 3	35 (97.2%)	6 (60%)
Plant 4	4 (11.1%)	1 (10%)
Plant 5	32 (88.8%)	8 (80%)
Total participants	36	10

There was a variety of responses to the statement:

> "*Traditional medicines can be just as effective as western medicines given in hospitals."*

This statement sought to find out the attitudes that learners and teachers have regarding the efficacy of the traditional plant medicines. Twenty one learners agreed with this statement and ten disagreed. Five learners did not tick either of the boxes and this could imply that they were unsure or unwilling to commit to a point of view or that they too did not understand the meaning of the term 'effective'. It seems fair to assume that since a majority of learners agreed to the statement, they actually have faith in the effectiveness of the plant medicines. For the learners who agreed with the statement, the common reasons were that there are some sicknesses that specifically require traditional medicines. One learner commented:

> *"Because if the sickness is getting worse at the hospital, they take you to see a traditional healer."*

This may be a trend observed by the learner in her society hence the assumption that specific diseases can only be cured using traditional medicines. One learner argued that, in the past there were no western medicines and people 'did not die' because they were treated using traditional medicines. Though the argument is weak, the learner seems to imply that traditional medicines were actually in use and worked before the African people were exposed to western medicines. One learner argued that traditional medicines are natural hence more effective than western medicines which are made of chemicals. All teachers disagreed that traditional medicines are more effective than western medicines. One teacher argued that:

> *"Western medicines are derived from natural plant products (traditional medicines) they have been processed scientifically, the active ingredients have been extracted. So they are more effective."*

The teachers' attitudes suggest that they have little faith in the traditional healers possibly as the teachers themselves are products of the western education system.

The learners who disagreed with the statement argued that, traditional medicines are not tested and sometimes cause death of patients. This could point to the lack of clear dosage instructions which arguably could result in deaths. The traditional healer contested this point saying that they give clear instructions and always give correct dosages but it is the patients who sometimes overdose the medicines. Most learners who disagreed tended to state that western medicines and traditional medicines were equally effective emphasising that some illnesses specifically require traditional medicines. One learner stated that:

> *"Some medicine you get from hospitals are just effective as traditional because they work the same they just differ with taste"*

One of the question required learners to state other names and uses of traditional medicines that they know of. Some learners had long lists whereas others needed to be reminded with pictures of plants they might recognise. One learner commented, "I don't remember, only if you can show me." The long lists by some learners could be an indication that the learners have more knowledge about the plants but just did not know the ones I pictured. It could also point out that the traditional healer being of

Shangaan origin might have picked the medicines more popular in his culture. Interesting to note were some of the medicines mentioned:

Setlapana: "*to make someone love you unconditionally"/ for good luck*

Moratiswa: *"to make someone love you"*

Weed (marijuana): *"cures headache"*

Isicitho: *"cleaning bad things you have been doing*"

Serokolo: *"when you come from a funeral then you can hold a baby"*

One learner (Tswana) wrote about the Moretlwa:

> *"A very powerful medicine that people drink when they have cancer for an example blood cancer and breast cancer. After (using) it as a treatment. Then you will not have anymore cancer in your life."*

This learner seems to have a lot of knowledge and faith in the efficacy of this medicine and might have had a direct observation of the medicine being used.

Another learner (Zulu) commented about the Sekanama:

> *"Is a very strong medicine that the kings used to punish other people who did wrong like to disobeying the law, killing someone....., beating your wife or children.....apply it in your body and sometime you feel like you are not yourself."*

Sekanama is in fact a herb which induces a very itchy sensation when rubbed against one's body. This could be the reason why the learners explains that it was for punishment/ torture purposes by traditional kings.

It is apparent that the learners have wide and deep knowledge about these traditional medicinal plants judging by the detailed responses to this question. They also showed great willingness to share this knowledge. Their statements are also made with a degree of certainty. Some learners used their vernacular language to explain the uses of the medicines. Teachers appeared reluctant to divulge knowledge of any other types of medicinal plants. Besides mentioning a few medicinal plants, some left blank spaces.

The last section of the questionnaire asked if learners would like to learn about traditional medicines or herbal plants, and if teachers would like to teach about traditional medicines in schools. Eleven learners out of thirty six said they were not interested in learning about traditional medicinal plants in schools. Fifteen learners were convinced they wanted to learn about medicinal plants in school. Six learners did not fill up the space whereas four said they were not sure. The main reasons for learners wanting to learn about traditional medicinal plants were merely to have knowledge. Some want to know and apply the knowledge to treat sicknesses and one learner stated that it could be a career choice:

> *"Yes because it can be part of these subject from grade 10 and you can want to be working with medicines. It is like a career."*

Some of those not willing to learn about traditional medicinal plants reasoned that there are many traditions (ethnic cultures) so it is not possible to learn about all the traditions and their medicines. Some learners stated that not all people believe that they work so there is no benefit in learning about them:

> *"...we live in urban areas...we don't get to know the plants....we will not gain anything from learning about them."*

It is very surprising that in all the reasons mentioned against learning about traditional medicinal plants, none of them was related to the fact that a learner was of a particular religion for example Christianity. This does not necessarily imply that these learners are atheist but could point to them belonging to religions that are accommodative of the traditional practices. Indeed some Christian churches embrace traditional practices.

Eight teachers said it was not a good idea to teach about traditional medicinal plants. They mostly cited the multi-cultural setting in South African schools which they claimed would hinder effective teaching and learning. Teachers seemed more concerned about the pedagogies- the how to teach and what to teach. One teacher however stated that they were teaching about the traditional medicinal plants currently:

> *"I teach about them in Natural Sciences when we do Ecosystems."*

Such a teacher could assist other teachers to develop effective pedagogies. This teacher was selected for interviews and his contributions are discussed further in section 4.4.

4.2 The ROSE type Questionnaire

As a follow up to the pictorial questionnaire, twenty of the thirty six learners, when they were in grade 10 (the succeeding year), were also requested to complete a questionnaire that was structured in the same format as the ROSE[2] questionnaire. This was done to check the general reliability of their earlier claims. The twenty were the learners that joined my Physical Sciences class for grade 10 and they all consented to participate. The questions related to what the learners wanted to learn about in schools, what they know about traditional medicinal plants, their general attitudes about traditional medicinal plants and *sangomas* (traditional healers) and what they view as important in their various cultures.

Sixteen out of the twenty learners agreed that they want to learn about medicinal plants in their area and nine of these sixteen want to learn about the use of traditional medicinal plants by *sangomas*. Only one out of twenty said they did not want to learn about medicinal plants in their area at all. This may not be surprising given the secretive nature with which such knowledge is held in African customs. The learners could be expected to be curious about such knowledge hence enthusiastic to learn about it in school. Interestingly the same sixteen learners also wanted to learn how other cultures use some plants as medicines. This may not only reflect enthusiasm on the part of these learners but may also be a reflection of the levels to which they embrace the concept of *ubuntu* that I alluded to in chapter two. Eighteen of the students also agreed that they want to learn about their traditional culture and how it compares with science. This further highlights that they do not consider their culture to exist in isolation to other worldviews or cultures-an important tenet of the *ubuntu* concept.

On section B of the ROSE questionnaire, that checked attitudes of learners, some interesting points were observed. Nineteen out of twenty learners agreed that students should learn about science and traditional knowledge in schools. The one

[2]ROSE-Relevance Of Science Education, a questionnaire distributed in many countries by Prof Svein Sjøberg, ILS, University of Oslo, Norway.

student who disagreed on this point also agreed that traditional medicines are not effective. The same learner is not interested in traditional medicines at all (question 12). The fact that the learner is of Zulu culture is surprising since the trend has been that the Zulu learners were more knowledgeable about medicinal plants and generally showed enthusiasm due to their detailed responses. This may suggest that this learner may have had some uncomfortable moments with traditional medicines hence the extremely negative attitude. Unfortunately the learner did not consent to be interviewed hence further probing was not possible. A noteworthy point also observed was that, despite the enthusiasm and some knowledge about medicinal plants shown by the learners in the visual questionnaire, fifteen out of the twenty were not sure if traditional medicinal plants are not effective. This is surprising considering that I assumed that these learners had faith in the efficacy of the traditional medicine. It could be that, behind the faith, they had some figments of doubt which were exposed when I directly questioned their confidence in the effectiveness of the plant medicines. This doubt is also shown in question six where nine learners were unsure whether traditional medicines can remove bad luck. This could also, perhaps, explain why the majority of the learners want to learn about the traditional medicinal plants. However in question 7, ten learners agreed that some illnesses require only traditional medicinal plants for their treatment. Interestingly ten learners were also not sure if science is always factual and true (question 5). Only six agreed and four disagreed that science is always factual and true. This reflects an element of doubt in some science ideas hence the tendency to show interest in traditional knowledge. Fourteen agreed that traditional knowledge can help the world to be better. This is a positive attitude although the exact elements of traditional knowledge are not specified. Even though generally learners showed interest in learning about traditional medicinal plants, only seven agreed that they were interested in learning about how *sangoma's* work. This could be out of respect of the seemingly sacred nature of traditional knowledge or possibly learners fear the rigorous training that a trainee *sangoma* (*thwasa* in Zulu) undergoes! A similar number agreed that selling traditional medicinal plants is a good career.

Questions 10, 11 and 12 were related and checked the learners' attitudes about traditional medicines as part of science content and traditional medicines in general. Thirteen learners said they were interested in traditional medicines and wanted to

learn more about them in class. This finding was confirmed in question 11 were fifteen learners disagreed with the statement that: I am interested in traditional plants for medicine but DON'T want to learn about it at school. These two questions were meant to check the reliability of learners' answers. This reflects a certain level of reliability of learner responses and that they did not merely complete the questionnaire. Furthermore sixteen learners disagreed to the statement: I am not interested in traditional medicines at all. These responses imply that the learners are interested in traditional medicinal plants and a majority of these learners would not mind learning about them in class.

Section C of the questionnaire allowed learners to speak freely about their views on traditional medicines and their culture. Most learners defined traditional medicines as 'organic', not processed or not 'modified' herbs, made from plants, mostly used by blacks and *sangomas*. One learner, Zulu speaking, was passionate about the medicines and wrote:

> *"The healers of our souls and lives. The root of the tree that saves lives. The true meaning of being an African."*

One learner was more sceptical stating:

> *"They are good and bad because other people they use it for bad and good reason, like they make us feel better when we sick and bewitch us when they hate us."*

This is the first statement by any learner that speaks to a relationship between traditional medicines and witchcraft. It is however not unexpected as this sentiment represents the 'mixed' feelings expressed by a majority of the learners especially as the majority were unsure of the effectiveness of the medicinal plants. What was noticeable was that generally the learners believed that traditional medicines are resorted to when western medicines have 'failed' or 'do not work'. An important aspect associated with traditional medicines raised by the learners is their ability to ward off "bad luck" or "evil spirits". Three learners mentioned the importance of traditional medicines in new born babies. One learner of Zulu descent mentioned that:

“its the helper of medical (western) medicines, and you can use it to cleanse bad luck, and is needed for new born babies who seem to need traditional help only.”

Another learner agreed with this and stated:

“....mostly we use it for babie(s) after the baby is born this is the medicine that is used on top of the baby’s head to make him/her strong.”

This learner appears to be knowledgeable about the particular medicine used to treat babies’ anterior fontanel problems. The learner also seems to believe that traditional medicines are mostly used for babies. However one learner explained that it boils down to belief:

“if we believe that they can help us, they can truely (sic) do help in some sicknesses.”

Responding to the question of what learners considered as important in their culture, seven learners mentioned that respect for elders and traditions and customs (*amasiko* in Zulu) was central in their culture. Four Zulu learners specifically mentioned traditional ceremonies such as initiation as important. One learner clarified how the traditions are dynamic and flexible:

“ We follow tradition, and when ever there is a use of medical help we go for it, we don’t have the mentality that as blacks only traditional herbs is needed to heal diseases.”

This may also reflect the semi-traditional lifestyles that urban dwelling South African children lead.

4.3 The class debate

The debate was done as a class activity and two teams comprising of five speakers each were selected by the learners themselves. I only had to divide the class into two based on which side of the class the learners sat. Two learners in the class adjudicated. The topic was:

“Traditional medicines are more effective than western medicines.”

The main challenge faced was language problems as learners could not communicate clearly in English. I decided to let them speak in their vernacular languages. This worked as participation improved although I had to look for a translator amongst the learners. The learners were very enthusiastic and participated keenly although some learners commented that they would have liked to choose whether to support or oppose the topic.

Learners who opposed the topic appeared to have more valid points. They argued that traditional medicines are usually resorted to only after western medicines, implying that the best and more effective form of treatment is chosen first. Even those supporting the topic agreed with this point but further argued that it proved that the western medicines were not all-effective and traditional medicines always come to the rescue. One learner added that it was a mistake to first visit the clinics, rather patients should go to the traditional healers first. The learner mentioned that people often go to traditional healers when it is too late resulting in deaths which lead to negative publicity on the part of the traditional practitioners.

An interesting factor was the association between use of traditional medicines and Apartheid and the use of western medicines with Democracy. Two learners mentioned that these days they have a choice (due to democracy) and they have access to western medicines which was not the case during the Apartheid era. The use of traditional medicines is therefore associated with the past. The attainment of a democratic government is thus linked to the access to quality healthcare through western medicines.

"*ke democracy gone jaanong*" literally translated means "*it's democracy now*"

One of the learners further claimed that these days when you visit traditional healers you are viewed suspiciously. This may reflect that in some sectors traditional medicines are despised and not accepted as an alternative form of healthcare. One learner even said that traditional medicines "lack ingredients". The learners' point is unclear but it could imply that potent chemical components found in western medicines are not present in traditional medicines by virtue of not being mentioned. This point was countered by one learner from the supporting side who claimed that most western medicines are actually derived from plants hence all medicines are

traditional but some are just “mixed with other chemicals”. This point got applause from the audience and indeed there is an element of truth in the statement.

In summing up I emphasised to the learners that despite the arguments put forward by both sides, it is important to respect the choices made by other people. In the discussion after the debate, the learners tended to agree that there are definitely some ailments that can only be treated or cured by traditional medicines. Although this is debatable it appears to be the popular view amongst this group of learners. Generally the learners appear to have a tolerant attitude towards the use of traditional medicinal plants even though some have doubts about their efficacy. They also show a great deal of enthusiasm for being able to discuss these issues.

4.4 Teachers’ Interviews

Two teachers were interviewed separately. The two had contrasting attitudes about the general integration of indigenous knowledge about traditional medicines into the science curriculum. Whereas one teacher was very supportive and passionate about the integration of medicinal plant knowledge into the curriculum, the other was very sceptical and doubtful of the success of such an innovation. The sceptical teacher stated that the high school science syllabus is congested and there was no time to teach “irrelevant” information. I was surprised why he would call such knowledge irrelevant so I further questioned him why he termed it so. He argued that:

> *“Our students get to varsity with little knowledge (science) because at high school there is too much to do and we never manage to do it.”*

As a science teacher, I understand his sentiments. However the assumption that he seems to make is that integrating such knowledge would consume a lot of time that could be used for ‘real science’. This suggests that the teacher may be lacking methodological skills to incorporate this knowledge in his ‘real science’ teaching time. When he was asked how comfortable he would be to teach concepts about traditional medicines, he vehemently said he would never be:

> *“I would never be comfortable. I know nothing about it.”*

I then asked him if he would be willing to allow someone knowledgeable about the plants to come into his class and teach on his behalf. He agreed to this and added

that he would learn a lot from that. He however said he would not allow a traditional healer to be the more knowledgeable person coming to teach in his class. The vehemence with which he stated this discouraged me from further probing why he would not permit a traditional healer in his class. It appeared to be a sensitive issue to him.

The second teacher was very supportive about of the integration of knowledge about traditional medicinal plants into the school curriculum. When asked if it was necessary for the integration of such knowledge, the teacher responded:

> *"Yes indeed, our cultures are slowly dying. I would prefer this to start at primary school*."

He passionately stated that this knowledge is very important.

> "*Mr Muza, this knowledge is very very important (gestures with hands). You see, our cultures have been taken over by foreign cultures. Our kids no longer value what we used to do in the past....All they think about is drugs and sex. You cannot take them (children) to the rural areas these days. They will report you for child abuse."*

The teacher recognises a challenge that may hinder successful implementation of the integration-that of lack of willingness amongst the learners. From the group of learners that participated in this research this appears not likely to be a problem since the majority expressed sincere willingness to learn about traditional medicinal plants. He however expressed optimism that societies would soon revert back to use traditional medicines especially with the "increasing cost of western medicines". He claimed that more and more people are now turning to traditional medicines in the search of a cure for HIV/AIDS.

He further gave examples of traditional medicinal plants that he "grew up using". I asked him why he stopped using them to which he replied that he could not say he stopped using them but rather he relies mostly on clinics and hospitals nowadays. He added that the lack of accessibility to the modern health facilities in the olden days hindered the use of western medicines.

> "...*back then, the nearest clinic was ten kilometres away."*

This teacher expressed willingness to incorporate the knowledge of traditional medicinal plants in his lessons adding that he does so especially when he teaches Ecology to his grade 9 Natural Sciences learners. I questioned him on the methods that he uses to teach about this to which he stated that it all begins as a class discussion with learners stating important plant medicines in their various cultures which he would list down followed by a field trip to identify such plants in local ecosystems or botanical gardens. He however emphasised the need for research into the common knowledge possessed by the different cultures especially in South Africa so as to avoid misleading learners on uses of the medicinal plants. On mentioning this point then I asked him who could be the best people to involve in the research and teaching about these medicines to which he responded:

> *"Traditional healers are the custodians of such knowledge. They are better qualified to teach about them...Personally I wouldn't mind having a traditional healer in my class though it's a bit sensitive."*

The teacher is willing to do as much as is possible for this knowledge to be accessible to learners but he also acknowledges that the methodologies of getting such information to the learners poses a serious impediment.

4.5 Learners' group interview- grade 10

I managed to interview four learners since the fifth learner was absent during the day I had scheduled for the group interview. The interview was semi-structured and learners were allowed to freely respond to a question posed. I hoped that this would encourage them to respond. However this was not to be as two learners were less responsive and appeared to be disinterested due to their silence in most questions. I got the feeling that the voice recorder was a bit intimidating to them since they had challenges in expressing themselves in English. In order to encourage participation, I allowed them to converse in their vernacular languages. This idea worked but there was a tendency for the learners to argue instead of just stating their points. It appeared the learners thought that they were still interested in debating whether traditional medicines where more effective than western medicines. One of the questions I asked them is:

> *What are your views on traditional medicines?*

One of the ‘talkative’ learners (Zulu speaking) stated that traditional medicines are important in their culture as they are used “*everyday*”. The learner was convinced of this and she added that her grandmother always gives her porridge with some *muthi* so that she does not suffer from diseases. She however could not name the medicine except that it was a brown powder like Morvite (a brand of powdered porridge). This was echoed but the second ‘talkative’ learner who said the porridge “makes you strong”. This is the first time I heard, in this research, that some traditional medicines act as a preventative measure against diseases. It reflects a certain degree of faith in their efficacy because it is difficult to prove that the medicine has actually prevented one from falling sick.

One other question posed to the panel was:

Do you think it is important to learn about traditional medicines at school?

The question was closed ended and all learners responded with “Yes” which was emphasised with a nodding of the heads. I was not convinced about this response since one of the ‘quieter’ learners had actually been very negative about traditional medicines in earlier responses to the ROSE-type questionnaire. It is possible that this learner is not exposed to the use of traditional medicines hence has this doubtful mind which sometimes is reflected with clear conviction that they don’t work as stated in her response to the questionnaire. This prompted me to ask all the learners if they knew any traditional medicines that really worked. Three of the four learners were positive and each stated a few names. The ‘quieter’ and ‘doubtful’ one shook her head. I did not probe further and closed the interview session.

4.6 Traditional healer interviews

The interviews with the traditional healer were all informally undertaken. We could not make appointments as he told me I was welcome at any time as long as he did not have patients. This was a good arrangement for me as I had several ‘interviews’ with him. As a courtesy gesture he also paid me a visit at the school where I teach. Unfortunately the security guards at the gate did not allow him in. I had to ‘consult’ him at the gate to the bewilderment of the guards. An apparent paradox was shown by this event: there is a cry for inclusion of IK in school curricular but the custodians of the IK are denied entry into the school premises. Here was a traditionally healer

so willing to share his knowledge but the system which ought to be welcoming him acts as a deterrent.

In all our conversations the traditional healer was enthusiastic. I could tell he felt a sense of recognition, an importance and a sense of greatness through his body language. I could have contributed to him feeling this way as I addressed him as '*Mkhulu*' (Zulu for the elder one). On one occasion I asked him how much he valued his knowledge about traditional medicinal plants. He replied that the knowledge is priceless and that it is not just about the medicines but about traditional values in general. He bemoaned the loss of these values to the extent of wishing he had a son or grandson with whom he could share the knowledge "*ngisaphila*" (Zulu meaning "whilst I am still alive"). This really explained the passion he has for his trade and the enthusiasm he showed in being interviewed.

On most occasions the traditional healer assisted in corroborating information obtained from the questionnaires especially about the correctness of the names and uses of the traditional medicinal plants. I couldn't question his knowledge; he seemed to know all his plants well. On one occasion he asked me to try some of his *imbiza* (a liquid medicinal extract from the African potato). I politely declined as I had heard about its potential to cause a running stomach within a few minutes. He seemed slightly offended. I unconvincingly explained that I was not sick but he said I needed it for prevention of diseases and cleansing the body and not necessarily curing illnesses. I was worried that the event could have exposed my 'hypocrisy' but he did not show it and after that he visited me at school. I asked him if he would be willing to join me in class to which he confidently agreed. I had to explain that the necessary protocol had to be followed before that could happen and he concurred with that. This gave me the confidence that he is one traditional healer who is willing to enter the classrooms and teach about traditional medicines and IK in general. The question that remains is: how may all the stakeholders in curriculum implementation, especially the teachers whose reluctance has been exposed, be coerced to implement the integration policy? To seek the probable reasons for teachers' reluctance and possible solutions I conducted some follow up discussions with the teachers who participated in this research and others who seemed keen on the discussions.

4.7 Follow up discussions

The major reason contributing to teachers' reluctance to incorporate IKS in general into their teaching appeared to be their lack of knowledge regarding concepts of IK. Teachers that I discussed with confessed that they did not know much about the various traditional medicinal plants. They highlighted the importance of teachers' content knowledge in their teaching. One teacher boldly questioned the idea:

"*How can I teach about something I don't know*?"

This lack of knowledge, which was also observed in the findings of the visual questionnaire, appears to be the central reason behind teachers' reluctance to incorporate the IK concepts into their teaching. This lack of knowledge could therefore explain teachers' reluctance to teach the concepts. Other teachers cited the multi-cultural setting of their classrooms as a factor that compounds the pedagogical aspects related to the teaching of traditional medicinal plant knowledge. They claimed that no two classrooms are the same from a cultural perspective. There is therefore no commonality of traditions hence subject matter content would have to be designed specifically to suit a particular context. Despite the cross-cultural similarities observed in this research, designing context specific science content is very difficult to achieve if not impossible. There is therefore need for accommodating pedagogies for example teaching IK through class discussions. This however may portray IK as less important than mainstream science and learners may view it with disdain. It is clear that challenges exist in the implementation of the integration policy and more still needs to be done in so far as the training of science teachers to integrate IK in their teaching is concerned.

Follow up discussions were also conducted with the learners. The learners were so enthusiastic and would stop me to ask how the research was going. I had promised to give them feedback on the findings hence I arranged a small discussion. Twelve learners managed to attend. Their general feeling was that my findings were a true reflection of their input. They concurred that they want to learn about traditional medicinal plants and that teachers (including myself) were less willing to teach about the medicinal plants in their Natural Sciences classes. They also did not feel surprised when I mentioned that Zulu learners got the 'highest marks' in the visual test. They explained that the Zulu's are many in Meadowlands and they have many

traditional ceremonies where they were taught about their culture. This was confirmed by the Zulu learners who were present. The question that emerges is how do we address these knowledge disparities between the cultures? This can be a subject addressed in further research. The general feeling I got was that the learners felt some sense of recognition and a level of being important for having been involved in deciding what they will learn. They were even freer to talk to me and consult on other academic matters especially career choices. This was also inspirational to me. The following chapter discusses the findings mentioned in relation to the research questions that I had at the beginning of the research.

Table 6: Summary of the data

Data source	**Emerging themes**	**Research question (RQ) addressed**	**Challenges**
Visual questionnaire of recognition of indigenous medicinal plants.	*Learners have more knowledge than teachers *Zulu learners have better knowledge than other cultures.	RQ 1 and RQ 3	*teachers' reluctance to give details- sacred nature of IK. *vernacular names given-difficult to check correctness. *illegible handwriting (few)
ROSE-type questionnaire of interests and attitudes.	*teachers have a more negative attitude to integration *learners want to learn about traditional medicines	RQ 2 and RQ 3	*interpretation of questions by learners/language barriers
Class debate	*More learners generally believe in the efficacy of traditional medicines *Some learners do believe that western and traditional medicines complement each other	RQ 2	*Use of English language inhibited effective communication
Interviews – teachers and learners	*One teacher very passionate about integration.	RQ 2 and RQ 3	*some teachers' refusal to be audio-tapped

	*learners more enthusiastic about learning IK		
Interview- traditional healer (Journal)	*traditional healer very willing to share his knowledge.	RQ 1 – correctness check of learner responses.	*language issues could not always decipher the meaning of his words.
Follow up discussions (Journal)	*teachers lack content knowledge to teach about traditional medicines hence negative attitude to integration. *learners have more positive attitude about integration.	RQ 1, RQ 2 and RQ 3	*poor attendance at follow up discussions

CHAPTER FIVE: DISCUSSION AND CONCLUSION

5.0 Introduction

The previous chapter on research findings exposed that, in general, both teachers and learners have mixed feelings about the idea of integrating knowledge about traditional medicinal plants into the science curriculum. The mixed feelings could be a result of the interaction of a number of factors which include the cultural background of the participants and their level of knowledge about the medicinal plants. In this chapter these feelings are discussed in relation to the research questions that I sought to answer at the beginning of my research.

5.1 RESEARH QUESTION ONE

What knowledge about a selection of traditional medicines for treating common ailments do Grade 9 Natural Sciences teachers and learners have?

The learners that participated in this research appeared to have better knowledge about the selection of traditional medicinal plants compared to the teachers. The learners had better knowledge of the names of the plants and knowledge of the uses accorded to the plants in the various cultures. Despite the various language backgrounds of learners participating in my research, it appears that the names of plants were common. This was not anticipated, but it was a relief for me as I did not have to know all the names given for the plants in the six different languages of learners participating in my research. Two plants were mostly named using their English names, the African Potato and the Aloe. Hence the knowledge of name turned out to be mostly knowledge of the common name. Something peculiar is the realization that in all the cases, knowledge of the name of a plant corresponded to a 'correct' knowledge of the uses of the plant. The correctness of the uses was verified by the traditional healer. What is clear is that the plant medicines generally appear to lack specificity in use, according to the traditional healer. A plant medicine could be used for two or more curative purposes. An example is the Aloe which is used to treat skin diseases, colds and flu and even relieve high blood pressure. The traditional healer confirmed that it was a multi-purpose herb. It would appear that some of these herbs could simply be immune system boosters, body tonics or antibiotics (Xaba, 2012) hence the wide variety of purposes.

It was observed that some learners visually identified the plants as medicinal because they had either used them or had experienced someone else using them. This was the distinguishing aspect between the teachers and learners. It appeared as if the teachers were reluctant to expose that they had knowledge about the uses of the plants through using them or experience of someone using them. The reasons behind are speculative: could it be that adults are more secretive than children or that the teachers feared being judged or that as adults they are aware of the 'protected' and secretive nature of such knowledge. These questions can only be answered by the teachers themselves through further research. It appeared to me that the teachers were a bit more secretive about exposing their knowledge and not necessarily that they did not know. They may have felt that their possible alignment with indigenous knowledge may have threatened their science teacher identity. For my part I would feel similarly reluctant and sceptical. My reluctance and scepticism arises from a genuine lack of knowledge about the medicinal plants.

An interesting observation was that the Zulu speaking learners appeared to have better knowledge of the names and uses of the selection of plants compared to the other tribes- Sotho, Tswana, Pedi (Northern Sotho), Venda and Shona. They also showed a higher level of knowledge of other traditional medicinal plants. This might be owing to the value given to traditional practices amongst the Zulus compared to other cultures. From experiences shared with the learners during classroom interactions, it might be that the Zulus are more involved in the activities of their culture especially the use of traditional medicinal plants and the consultation of traditional healers compared to other cultures in the area of the study. Zulu learners often ask for permission to be away from school for *umsebenzi* (traditional ceremonies). What then could be the explanation behind the seeming docility of the other cultures in the group of participants in this research? It could be that the population of the location of my research, a township school in Gauteng, is dominated by Zulus hence they are more 'visible' and can easily partake in their cultural activities due to their superior numbers. This could be also the reason behind the seeming prevalence of Zulu *sangomas* and their trainees (*thwasas*) that I have seen regularly in the streets of the township. The apparent dominance of the Zulu culture is also reflected in that the Zulu language appears to be the common language in the streets as, often times I have observed that non-Zulu learners strive

to communicate in the Zulu language in their day to day social interactions. The Zulus on the other hand, do not seem to be keen to converse in other languages other than their own. This could speak to an element of the Zulus being proud of their culture or, as I propose, the Zulus valuing their traditional practices more significantly.

It is therefore important that the indigenous knowledge of the different cultures be documented. It appears though, according to the findings in my research, that there is some commonality amongst the cultures in as far as the knowledge of use of the various traditional medicinal plants is concerned.

5.2 RESEARCH QUESTION TWO

What are a group of South Africa Grade 9 and 10 teachers' and learners' attitudes about integration of medicinal plant knowledge into the school science curriculum?

Almost 90% of the learners that participated in this research gave a positive response to the need to introduce knowledge about traditional medicinal plants into the school sciences curriculum. They indicated that they wanted to learn about the plants. This is not totally surprising given the enthusiastic and inquisitive nature of the grade 9 learners in my school. This augurs well for the teaching of knowledge of medicinal plants as it could imply that the learners are ready to learn and are motivated.

The positive attitude of the learners was however not reciprocated by the teachers. The teachers' expression of doubts over the need to introduce knowledge about medicinal plants into the curriculum could be a result of their being unfamiliar with the medicines as indeed their content-knowledge answers indicated. It could also be that the teachers were concerned about the pedagogical challenges they could face in teaching content not familiar to them. These teaching challenges could be worsened if the belief systems of either the teachers or the learners are at loggerheads to the indigenous traditional African belief systems. An example could be the dilemma that a traditional African teacher may face when teaching a Muslim or Christian class who do not believe in the efficacy of the traditional medicines. One thing clear though is that the teachers who participated in my research, being

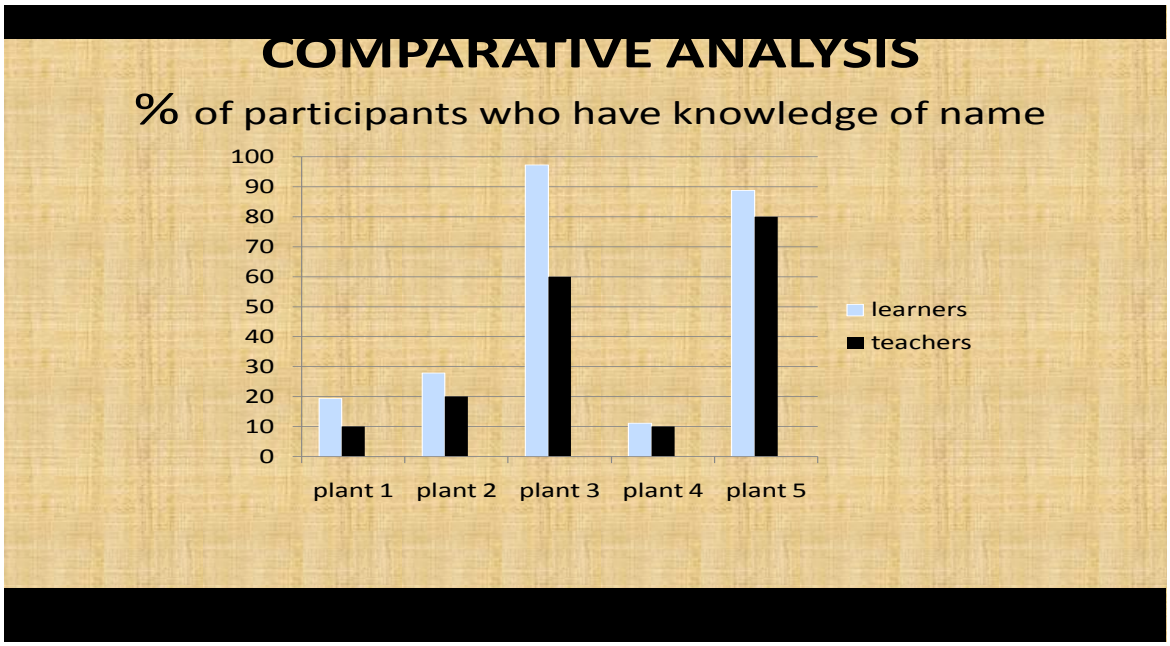
products of a western science education in the traditional curriculum, would not freely expose the need to have the curriculum to which they are products of to be changed (Manzini, 2000). This could be due to the status accorded to them as 'science' teachers and their commitment to the scientific paradigm. The tendency to resist change or innovations in curricular appears to be common amongst teachers the world over. Altinyelken (2010) confirmed, in a study of teachers in Turkey and Uganda, that teachers resist change proposals when the changes are in conflict with their perceptions of the benefits of the change. It seems that the teachers do not necessarily disagree with the changes but that they are worried lack of content knowledge and having to develop new skills, analogies and representations- what Shulman (1987) termed pedagogical content knowledge (PCK)- that suite the new topic.

5.3 RESEARCH QUESTION THREE

How do the knowledge and attitudes of teachers and learners compare?

The graph below illustrates a comparative analysis of the findings for knowledge of names of the selection of plants possessed by the learners compared to the teachers.

Graph 1: comparative analysis of knowledge of name of the selection of plants



It is evident that in all plants learners showed better knowledge of the names of the selection of plants. The trend was maintained with knowledge of other traditional medicinal plants. The teachers seemed less knowledgeable of other medicinal plants compared to the learners. This obviously poses a challenge as to the teaching methodology to be employed by the teachers if they were to teach about traditional medicinal plants. The teachers may, thus, not be expected to be more knowledgeable than learners. An argumentation approach to introducing concepts on IKS as advocated for by Hewson & Ogunniyi (2008) may be a possible solution. Teachers seem to agree that argumentation is a viable approach to teaching science and introduce IK into the classroom (Hewson & Ogunniyi, 2011).

The attitudes of the learners and teachers towards the need to integrate traditional medicinal plant knowledge into the science curriculum were contrasting. The major reason given by the teachers was that the multi-cultural setting characterising South African schools may impede harmonious and effective teaching of the Indigenous Knowledge concepts. The different cultures would be expected to have their own interpretations of phenomena and different methods of treating ailments. The challenge is therefore on the designing of effective instructional practices that would be appropriate. The teachers' attitudes appear to be based on this challenge which they feel would not foster effective teaching. A challenge therefore to the implementation of an integrated science-IKS curriculum would be teacher preparedness to teach the concepts. Appropriate training for the teachers and development of relevant textual materials could go a long way in improving teacher knowledge on IKS and sustain the high levels of interest and motivation amongst the learners. The contrasting attitude could be an issue of a generation gap existing between the learners and teachers but it could have negative implications for successful integration of IK and the school science curriculum. Paradoxically however the generation gap was expected to reflect the opposite, teachers as elders may have been expected to show better interest in traditional ways than the learners and not vice versa as discovered in the findings.

There were significant doubts about the effectiveness of the traditional medicines amongst both the learners and teachers. This is strange considering that the learners were so enthusiastic about learning about the plants.

5.4 Summary of main themes

Some of the main themes emerging from this research are that:

- Learners had more knowledge than teachers about the names of the selection of plants.
- Learners and teachers that participated in this research have opposing attitudes regarding the need to integrate knowledge about traditional medicinal plants into the science curriculum.
- Zulu learners appear to have more knowledge about medicinal plants than other cultures in the study hence positive attitude to integration.
- Some medicinal plants are reported to have a wide variety of curative properties- yet there are many commonalities across the cultures.
- Teachers in this study were generally less enthusiastic about teaching about traditional medicinal plants than learners were about studying them.
- Religion was not mentioned as a factor influencing the attitudes that both teachers and learners have towards traditional medicinal plants' effectiveness.

5.5 Limitations

When I undertook this research there are some limitations that I feel could be improved in order to improve the validity of the findings. The nature of IK is such that it is convoluted and may be difficult to decipher given the multi-cultural setting in South Africa. Different cultures will have different interpretations of phenomena unlike western science which appears to be linear and universal. IK is sacred especially about traditional plant healing. The metaphysical aspects and the links to witchcraft were beyond the scope of my research but they could be investigated in further studies and could have given me an idea of the ailments linked to these aspects and the role played by medicinal plants in the ailments.

The group interviews of learners elicited information mostly from the outspoken learners who overshadowed the quieter learners. This was however done to enable a freer environment for the learners to communicate their ideas rather than on a one-to-one basis with me as an authoritative figure.

5.6 Directions for further research

It is envisaged that the findings from this research may serve as pointers to further research. Certain factors have to be taken into cognisance. It would be interesting to compare my findings with the findings that could be obtained from a rural setting with rural learners and teachers. The rural areas appear to be the repositories of IK and where the more authentic custodians of IK mainly the elderly, traditional healers, chiefs and headmen reside. More rich data and less negative attitudes may be expected to prevail in such settings. It is important to involve the custodians of IKS in any research on IKS in order to improve the authenticity of claims arising from participants. It could be also interesting to find out the views held by teachers and learners of other races if they were participants in a similar research. It could be worth finding out also why the Zulu learners appear to have better knowledge than other learners of other tribes.

However current research seems to be mainly about investigating the pedagogical aspects by which IK can be integrated into the classroom practices. Teachers' instructional practices influence the effectiveness of the overall integration process. A systemic approach to integration is called for. Hewson & Ogunniyi (2008; 2011) showed that through intervention courses, teachers' attitudes and knowledge about IKS and the relevant instructional practices improved. They have proposed and argue for an argumentation based discourse as a viable approach to teaching science and introduce IK into science classrooms. Ogunniyi (2007) in one of his intervention courses- Practical Argumentation Course (PAC) to teachers he observed that after the course, teachers had an enhanced understanding and awareness of the need to implement a science-IKS curriculum and they were more sceptical of the notion that western science is the only way of knowing and interpreting experiences and the notion that IKS was based on superstitious beliefs. Such courses could also enhance teachers awareness and understanding of the roles played by traditional medicinal plants in the treatment of common ailments.

5.7 Conclusions

The findings of this study show that the majority of students have different attitudes to the teachers regarding the integration of knowledge about traditional medicinal plants into the science curriculum. Most students had a better knowledge of traditional medicinal plants than the teachers and many students are keen to learn about traditional plants whereas the teachers are far more sceptical. The limitation in knowledge about traditional medicinal plants and the apparent scepticism reflected by the teachers are understandable given the pedagogical challenges to teach indigenous knowledge. Moreover, the low status accorded to indigenous knowledge in comparison to western science (Ogunniyi & Hewson, 2008) has a negative disposition on teachers towards the implementation of the IK-integration policy. In the absence of appropriate guiding frameworks on the IK-integration policy into western-oriented science curricula, this policy in Zimbabwe and other comparable nations will remain a pipedream (Mpofu, 2013).

Zulu students appear to have more knowledge about medicinal plants than other cultures in the study and hence an even more positive attitude to integration. According to the knowledge claimed by students and the traditional healer, some medicinal plants appear to have a wide variety of curative properties. The content challenges of this kind of knowledge would be great for the practical integration into science. It was interesting to note that for both teachers and students no mention was made of religion influencing their attitudes towards traditional medicinal plants' use or perceived effectiveness. A further finding was the effect the research process had on the attitudes and engagement of students in the regular science classes. Many seemed to feel freer to communicate their ideas having experienced the openness of the space to value other worldviews and knowledge. This enthusiasm showed by learners reflects the need that learners have, to attach a social meaning to their learning. This need echoes the challenge that science education reform advocates (discussed in chapter 2) have in addressing the issue of creating a relevant science education curriculum. The fact that the learners in this study know more about traditional medicinal plants than teachers confirms the views of constructivists who acknowledge that a learner is not a *tabula rasa* or blank slate waiting to be filled. Rather, learners acquire some knowledge through their social interactions- also confirming the ideas of socio-culturists like Vygotsky who

acknowledge the importance of learners' prior knowledge derived from their social interactions (as discussed in chapter 2). It can be expected that learners possessing relevant prior knowledge to a concept will be better able to learn, side by side, the concepts from their traditional worldview and the concepts from the scientific world view. This is what Jegede (1997) referred to as collateral learning. Hence learners in my study would be expected generally to be capable of dependent collateral learning whereby a student uses ideas from their traditional worldview to challenge or understand the views from the scientific worldview. Such learners would also be expected to easily negotiate the transition from their traditional worldview at home to the scientific worldview in the science class i.e they should be able to achieve smooth border crossing.

One thing clear is that integration of Indigenous Knowledge Systems into the curriculum is experiencing some challenges especially at classroom level and this could be due to the apparent knowledge gap of teachers and cultural ideological differences between IK and the science classroom. At this level the advocates for integration need to be aware of the complexities of integration as they may not be really in touch with the happenings in the classroom on a day to day basis.

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APPENDIX 1

Questionnaire (learners) **code** ☐

Dear respondent,

I am carrying out a research on the knowledge of both the teachers and learners on '*their knowledge and the attitudes about the medicinal plants.*' All the information provided will be treated confidentially. I therefore kindly request you to complete this questionnaire as honestly as possible. Thank you!

INSTRUCTIONS: Please DO NOT write your name on any part of this questionnaire.

SECTION A: BIOGRAPHICAL INFORMATION

1 Your age: _____

2 Your tribe: _____

SECTION B: KNOWLEDGE AND ATTITUDES ABOUT TRADITIONAL MEDICINES.

1. Below are pictures of samples of some medicinal plants and 'medicines'. Respond to the best of your knowledge the questions that follow each picture. Feel free to leave a blank if you are not aware of the plant/medicines.

Pic 1.



a) Do you know this medicinal plant? Yes ☐ No ☐

b) If yes state (i) its name _____

(ii) what it is used to treat _____

_____

c) Do you think it is effective in treating the disease(s)? _____

_____

Pic 2



a) Do you know this medicinal plant? Yes ☐ No ☐

b) If yes state (i) its name _____

(ii) What it is used to treat _____

_____

c) Do you think it is an effective medicine? Explain your answer. _____

_____

_____

Pic 3



a) Is this a medicinal plant? Yes ☐ No ☐ don't know ☐

b) If you know it, state its name. _____

c) What is it used to treat/cure? _____

_____

d) Do you think it is an effective medicine? Explain your answer. _____

_____

_____

Pic 4



a) Do you know this medicinal plant? Yes ☐ No ☐

b) If you know it state (i) its name _____

(ii) what it is used for? _____

_____

Pic 5



a) Have you ever seen this plant? Yes ☐ No ☐

b) If yes, where have you seen it? _____

c) Do you know what it is used for? Yes ☐ No ☐

d) If yes, for what illness is it used for? _____

e) Do you think this plant is effective? Yes ☐ No ☐

2. “Traditional medicines can be just as effective as western medicines given in hospitals”

Do you agree or disagree with this statement? Agree ☐ Disagree ☐

Explain your answer briefly. _____

_____

_____

3. Do you know of any other traditional medicines? If so, state their names and their uses.

_____

_____

_____

_____

_____

_____

_____

SECTION C : ATTITUDES TOWARDS INTEGRATION INTO THE CURRICULUM.

Do you think knowledge about traditional medicines should be taught in schools? Explain fully. _____

_____

_____

_____

_____

Thank you for your time!

APPENDIX 2

Medicinal Plants in my culture.

The purpose of this questionnaire is to find out what you think about traditional plant medicines and science. Your answers will remain anonymous so do not write your name on this document.

I am _____ years old.

I am from the _____ culture.

SECTION A : WHAT I WOULD LIKE TO LEARN ABOUT.

How interested are you to learn about the following. Just put a tick in appropriate box.

	yes	**no**	**maybe**
1. The use of traditional plant medicines by *sangomas or herbalists*	☐	☐	☐
2. medicinal plants in my area	☐	☐	☐
3. how other African cultures use some plants as medicines	☐	☐	☐
4. My traditional culture and how it compares with science	☐	☐	☐
5. Only science like we have already	☐	☐	☐

SECTION B : MY ATTITUDES

To what extent do you agree with the following statements:

	agree	**not sure**	**disagree**
1. Students should learn about science and traditional knowledge in school	☐	☐	☐
2. Traditional plant knowledge should not be taught at school	☐	☐	☐
3. Traditional medicinal plants are not effective.	☐	☐	☐
4. Traditional knowledge can help the world be better	☐	☐	☐

5. Science is always factual and true.	☐	☐	☐
6. Traditional medicines can remove bad luck.	☐	☐	☐
7. Some illnesses require ONLY traditional medicines.	☐	☐	☐
8. Selling traditional medicines could be a good career.	☐	☐	☐
9. I am interested in how *sangomas* work	☐	☐	☐
10. I am interested in traditional plants for medicine and want to learn more in class	☐	☐	☐
11. I am interested in traditional plants for medicine but DON"T want to learn about it at school	☐	☐	☐
12. I am not interested in traditional medicines at all	☐	☐	☐

SECTION C: Please just complete the following sentences any way you think… (Think like a rapper!)

Traditional medicines are
……
……
……

What I know about traditional medicines is
……
……
……

What is important in my culture is
……
……
……
……..

THANK YOU, NGIYABONGA, KE A LEBOGA!!!!

APPENDIX 3

SAMPLE QUESTIONS- learner

	yes	no
1. Do you think it is important to learn about traditional medicines?	☐	☐

2. Briefly explain the reason for your answer to question one.

---

	yes	no
3. Do you think traditional medicines are as effective as western medicines?	☐	☐

4. State the reason for your answer to question 3.

---

	yes	no
5. Before you were taught about traditional medicines in class did you know any traditional medicines?	☐	☐

6. If you answered yes to question 5 briefly state any traditional medicines that you know.

---

	yes	no
7. Do you enjoy being taught about traditional medicines	☐	☐

APPENDIX 4

Graph 1: comparative analysis of knowledge of name of the selection of plants

