XHOSA INDIGENOUS KNOWLEDGE: STAKEHOLDER AWARENESS, VALUE, AND CHOICE

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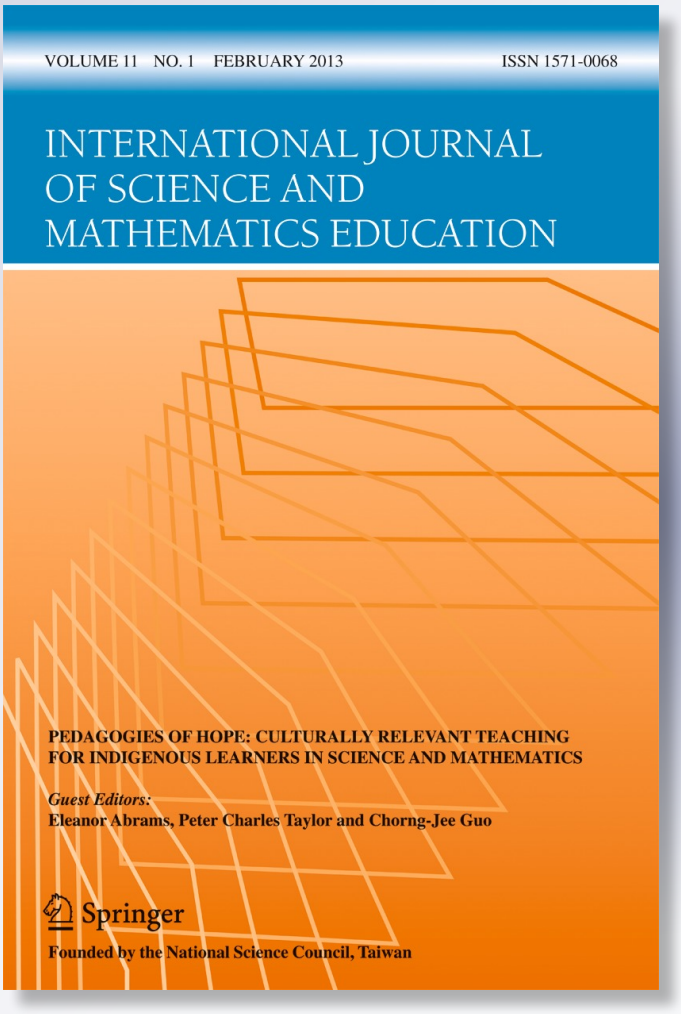

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XHOSA INDIGENOUS KNOWLEDGE: STAKEHOLDER AWARENESS, VALUE, AND CHOICE

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ABSTRACT. This study investigated a sample of isiXhosa mother tongue-speaking science teachers', their pupils', and adult local community members' awareness of Xhosa indigenous knowledge. It also investigated what aspects of this knowledge they value and think should and could be integrated into the school science curriculum and their reasons for suggesting that it should (or should not) be incorporated. The participating teachers voluntarily completed an open-ended questionnaire. On completion, they were given the task of administering the questionnaire to at least 1 of their pupils and 1 community member who they believed could contribute ideas about indigenous knowledge that might relate to science education. Interviews were held with a small sample of teachers and community members. The data generated suggest that there is a shared awareness of indigenous knowledge across the respondents (teachers, pupils, and community members). The reasons given for including indigenous knowledge in the school curriculum related mainly to the realm of recognition (social justice and cultural sensitivity), and there was also little evidence that the respondents were aware of current understandings underpinning the demarcation of science and indigenous knowledge as disciplines.

KEY WORDS: cultural recognition, indigenous knowledge, school curriculum, science, Xhosa

Introduction

Calls have been made over recent decades to broaden the science curriculum to accommodate alternative sources of knowledge known as, amongst other titles, traditional knowledge, aboriginal knowledge, indigenous knowledge, traditional environmental knowledge, ethno-science, indigenous science, etc. (Hodson, 2009). These calls have influenced the activities, instructional practices, and curricula in schools in a number of jurisdictions such as Hawaii (Chin, 2007), Tonga (Palefau, 2005), Canada (Aikenhead, 2006), New Zealand (Ministry of Education, 1993; Roberts, 1998), and South Africa (Department of Education, 2002; Malcolm, 2007). Arguments for including "indigenous science" have centered largely on the notion of the devaluing of cultures which traditionally rely on naturalistic observation and insight (Kawagley, Norris-Tull & Norris-Tull, 1998); principles of equality, of respect, and

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worth that underpin multicultural and anti-racist education (Taylor, 1994); the maintenance of cultural identity (Ogawa, 1998); the depth of alternative ecological knowledge available (Christie, 1991); and perceptions that the processes of science and indigenous knowledge follow similar lines (Stanley & Brickhouse, 2001).

Cautionary arguments have been that, although the tenets of the nature of science are tentative and at times vigorously contested by researchers in the philosophy of science (Hodson, 1986; Lederman, 1992), the epistemological underpinnings of the activities of science, and the ontological characteristics of the resulting knowledge, are stable and robust enough to demarcate science as something separate from traditional knowledge or any of its homonyms (Good & Shymansky, 2001). Hodson (2009, p. 118) points out that the substance of traditional knowledge, as science debate often rests on the "the politics of recognition," amongst other issues, redress the imperialism of the past. While recognizing the validity of this stance, he warns of the dangers of relativism inherent in including "anything and everything in the curriculum under the banner of science." Similarly, Southerland (2000) believes that forcing all forms of knowledge about nature and naturally occurring events, and quantity, order, and shape, into the construct of science sets no boundaries for the limits of the discipline. Horsthemke & Schafer (2007) reject the notion of ownership of knowledge along ethnic and indigenous divisions and argue that the term indigenous knowledge has become a bandwagon-type concept that has been used uncritically by politicians to further their own agendas. They also note that (indigenous) schoolchildren frequently reject the incorporation of "African" studies into the school curriculum, viewing it as "irrelevant, exotic, backward, and culturally alienating" and warn against the assumption that anything using the label "indigenous" should automatically be accepted and embraced (Horsthemke & Schafer, 2007, p. 5).

Arguments for a cultural perspective of education view teaching as cultural transmission and learning as culture acquisition (Aikenhead, 1996), where culture is understood as "an ordered system of meaning and symbols, in terms of which social interaction takes place" (Geertz, 1973, p. 5). More specifically Phelan, Davidson & Cao (1991) view culture as the norms, values, beliefs, expectations, and conventional actions of a group. Aikenhead (1996) points out that cultural subgroups exist which can commonly be identified by nation, tribe, language, location, religion, gender, occupation, etc., with each subgroup being composed of people who conform to a defining set of norms, values, beliefs, expectations, and conventions which, barring minor diversity, provide a source of identity.

However, Gadicke's (2005) work with Canadian First Nation people has shown that traditional knowledge can vary drastically across tribes and even across regions within traditional territory, and Snively & Williams (2008) point out that indigenous knowledge claims about nature and naturally occurring events are place-specific and are not intended to be generalized beyond the specific people and place. Such perspectives and findings suggest that, before attempting to find specific solutions and materials to help facilitate cultural border crossings for what one may consider to be indigenous students, one should be clear as to what knowledge the group (or at least the majority therein) consider to be "their" traditional knowledge and explore their views on the appropriateness of the inclusion of such knowledge in the school curriculum. This caveat underpins the rationale for this study which investigated isiXhosa mother tongue-speaking pupils', teachers', and adult community members' (n = 294) awareness of Xhosa indigenous knowledge and whether they believe that it should be integrated into the school science curriculum. The issues highlighted by the study are considered in light of the epistemological dilemmas posed when teaching science (as a clearly demarcated discipline) in constructivist-oriented, diverse, multicultural classrooms which require teachers to both access and challenge prior knowledge about science while honoring and respecting individual students' beliefs (Yore, 2011).

Background

There are data on teachers' understandings, stances, and practical arguments regarding science–indigenous knowledge (Ogunniyi, 2007a, b); the roles played by teachers and community members in developing a science curricula (Aikenhead, 2002); and how teachers' conceptions of, and awareness about, the nature of science and indigenous knowledge systems change over the course of an intervention to enhance their understanding of these concepts (Ogunniyi & Hewson, 2008). Other studies have highlighted the difficulties and barriers faced by students of non-Western backgrounds when learning science and mathematics (Aikenhead, 2006) and the clashes in worldview between local cultures and the culture of science (Malcolm, 2007).

Malcolm (2007) has pointed out (as have others) that the scientific worldview sometimes collides with aspects of traditional African cultural worldviews and that these may cause discomfort to, and alienate, African students, causing them to opt out of science at school. Ogawa argues for the

adoption of the traditional cultural context of *Shizen* in the Japanese curricula—a distinct worldview that requires emotional, spiritual, and aesthetic engagement with nature. Kawasaki (1996) also points to the many problems Japanese students face when learning science, while Jegede (1995) and Aikenhead & Jegede (1999) propose a notion of "collateral learning" whereby students hold and develop Western scientific thinking alongside traditional knowledge. However, such issues are not restricted to Africa and Asia. Hodson (2009) notes that any student with a preexisting worldview that is not in harmony with scientific perspectives will find it more difficult to learn science because it may not make sense to them in terms of their underlying assumptions and values. Also, students who have grown up in a Western culture, but who have strong religious, spiritual, or aesthetic conceptions of the natural world, may experience science as a threat to the long-standing beliefs and values which underpin their personal identities (Cobern, 1996; Roth & Alexander, 1997).

Hodson (2009) notes that, apart from the argument that the introduction of traditional knowledge may play a major role in personalizing learning and assisting border crossing, it can be a crucial element in cultural stabilization and renewal. Notable political thrusts toward cultural renewal are exemplified by the positions taken in New Zealand and South Africa. New Zealand teachers are urged to make science more relevant and more accessible to Maori students by acknowledging Maori cultural beliefs and values (Ministry of Education, 1993). Schools are encouraged, where appropriate, to teach science through the Maori language (Ministry of Education, 1996) and from a Maori perspective by adopting culturally relevant pedagogical practices (McKinley & Keegan, 2008; Wood & Lewthwaite, 2008). The South African Revised National Curriculum Statement (Department of Education, 2002, p. 10) states that one of the goals of the curriculum is to "integrate indigenous knowledge systems with school science throughout the entire school system." This directive, which to some may indicate the inclusion of traditional knowledge as a constructivist strategy to engage culturally diverse students into scientific study, may also place teachers in a dilemma in which science and traditional knowledge may collide and for the introduction of personal views about nature and naturally occurring events involving magic, mysticism, and spiritualism, which may be personally valuable, but which are not science (National Research Council, 1996).

Despite political support, achievement of the aims above has not been unproblematic. In New Zealand, there are unresolved tensions between

"science in Maori" and "Maori science" (Stewart, 2005) and continuing debates over terminology (McKinley & Keegan, 2008). In South Africa, Horsthemke & Schafer (2007) call for more critical interrogation of things "ethno" in education and challenge notions of "Western," "Eurocentric," and "ethnic' science." Ogunniyi (2007a) notes that, while progress is encouraging in terms of integrating indigenous knowledge in the science and mathematics curricula in South Africa, many teachers are uncertain about what is required and question their ability to respond to what appears to be radically different teaching and learning pedagogies. Southerland (2000), in attempting to unravel such demands, distinguishes between *instructional multicultural science* education to meet the needs, interests, aspirations, and values of diverse students and *curriculum multicultural science* which aims at redefining our conception of science (she accepts the former and rejects the latter). Finally, Hodson (2009) notes that the assumption that all members of a cultural group should and do share a particular set of views can be a restrictive one for individuals, and Irzik & Irzik (2002) see this assumption as being potentially damaging for the knowledge itself as it insulates it from criticism and fossilizes it in its current form.

Calls for more relevant curricula and teaching practices, and the tensions described above when attempting to implement these by introducing indigenous knowledge (because of its challenges to the demarcation of science and assumptions of shared views within a culture), beg a number of questions. These are questions of whether apparently culturally homogenous groups, such as isiXhosa speakers, have a shared understanding of their indigenous knowledge, whether they value this knowledge in terms of its inclusion in science education in their schools, and what their reasons might be for taking a particular stance.

Research Design and Methodology

A multiple source survey of teachers, students, and community members with a follow-up interview design was used to document indigenous knowledge and pedagogical insights for incorporating such knowledge into school science curricula. Teachers, who were registered on a part-time, university-accredited science and mathematics upgrading program (BEd) offered by a South African university at four sites across the Eastern Cape province served as a targeted convenience sample. The teachers were requested to voluntarily complete an open-ended questionnaire during class time on their awareness of:

- Xhosa indigenous knowledge related to science education
- Why they think this knowledge is important
- Their opinions as to what could and/or should be integrated into the school science curriculum

Section A of the questionnaire solicited biographical details. Section B explained the aims of the research and then presented four open-ended questions which asked, "What indigenous knowledge do you feel is important for schoolchildren to learn," "Why do you think it is important," "What indigenous knowledge do you feel should be included in the school science curriculum," and "How should indigenous knowledge be integrated into the school science curriculum (Please explain your answer)?"

The teachers were then provided with extra copies of the questionnaire (with section A suitably amended for the intended targets) and asked to administer it to at least one of their pupils and to at least one community member who they believed could contribute to understandings of Xhosa indigenous knowledge and its applicability to the school science curriculum. This approach yielded a high response rate in all three categories: teacher, pupil, and community member (only three teachers did not provide responses from community members).

The teachers were told that they could assist their pupils and community members in terms of their understanding of the questions: translation from isiXhosa to English and vice versa, if necessary, and by writing their selected community members' responses for them if they were illiterate. The questionnaires were returned, inspected, and analyzed inductively in order to categorize the responses (McMillan & Schumacher, 1993). The results were then used to inform interview questions and respondents to be interviewed in order to probe and validate our understanding of their meanings. Approximately 1-h interviews, which were audiotaped and transcribed by an English first-language researcher aided by a isiXhosa home language teacher/translator, were carried out within 3 weeks of receipt of the questionnaires that had been administered at all sites during the same week and collected within 2 weeks after administration. A small sample of teachers and community members including a sangoma (traditional healer) were interviewed. These interviews endorsed the questionnaire findings and did not reveal any data that had not already been obtained, thereby indicating "convergent reliability." In other words, when the data obtained by one measure agrees with the data obtained by another, it can be said that a degree of validity has been obtained (Cohen, Manion & Morrison, 2000).

Setting

The Eastern Cape province in South Africa has a population of approximately 6.5 million people who are overwhelmingly (more than 80 %) isiXhosa-speaking (particularly in the rural areas) and, as such, provides a largely mono-cultural milieu in which to investigate issues of indigenous knowledge. The province was formed in 1994 out of the nominally independent Xhosa homelands of Transkei and Ciskei, together with the eastern portion of the Cape Province, and covers approximately 14 % of the area of South Africa (169,580 km^2). The tuition sites (blended learning/educational outreach sites) from which the teachers were drawn, namely, Mthatha, King William's Town, and Queenstown, serve extensive rural areas, while Port Elizabeth is a large industrial city of approximately 1 million inhabitants. Although isiXhosa was the first South African indigenous language to be reduced to writing by missionaries in the early 1820s, the amaXhosa (the Xhosa people) have retained an oral tradition with the elders expected to be the knowledge keepers and storytellers.

Sample

Seventy-three grade 6 – 12 science teachers participated in the survey and also provided 143 responses from their pupils and 78 from community members. Most of the teachers (more than 80 %) were between the ages of 30 and 50 years. The age distribution of the community members was skewed to the right, with 65 % falling into the age range 30 – 50 years and 15 and 10 %, respectively, falling into the 50 – 60 and 60 + brackets. Approximately 40 % of the pupils were 16 – 19 years of age, while the rest were younger (between the ages of 12 and 15 years). The male/female distribution ratio was 40 % male and 60 % female in each of the three groups. The language of instruction in all of the schools is English. The sample sizes drawn from the four sites were roughly equivalent. The resulting samples of respondents were not assumed to be representative of the populations of teachers, pupils, and community members in these four geographic areas, but rather as groups of informed and interested participants.

Data Interpretation

The data were considered in terms of the three source groups (teachers, pupils, and community members) and the three issues being investigated: awareness of Xhosa indigenous knowledge within and across these

groups; what aspects of this knowledge they thought should be integrated into the school science curriculum; and their reasons for suggesting that it should (or should not) be incorporated. As noted earlier, inductive analysis was used to order and categorize responses.

Reliability, Validity, and Ethics

Kvale (1989) draws attention to the fact that communicative validity involves testing of claims within discourse. He points to Habermas' discourse theory which requires members of the interpretive community to make decisions of truth and value. In the case of this study, the teachers, pupils, and community members formed the interpretative community. Some of the community members were limited in terms of English and were questioned and encouraged to answer in isiXhosa during the interviews and when responding to the questionnaire. Brislin's forward–backward translation procedure (Meadows, 2003) was used; that is, the interpreter used for the interview translated the question from English to isiXhosa while a second isiXhosa home language speaker translated them back into English. The procedure was reversed (from isiXhosa to English and then back to isiXhosa) during the transcription process.

While the administrators of the research in the field were amaXhosa, the principal investigator was not (White South African male with English as the first language). This information was clearly relayed to the participating teachers (who knew the principal investigator on a professional basis as a university representative of their program of study), and they were asked and expected to relay this information to the pupils and the community members who participated. All participants were informed in writing that their participation was voluntary, that they could withdraw at any stage, that they would remain anonymous, and that the data generated would be used for research purposes and publication, in accordance with the research ethics code of the university. The rationale for, and the expectations of, the research was explained to the teachers and given to them in written form in English. Once the process had been explained, all of the teachers, pupils, and community members agreed to participate. One community member declined to be audiotaped during his interview and only field notes were taken.

Results

Overall, the data generated by the teachers, pupils, and community members appeared sufficiently homogenous across the four sites and

various schools and grade levels to be reported as a group response. Where there were apparent differences between the different groups, these are noted in the narrative that follows. The responses are grouped as technology-oriented activities, health-related issues, witchcraft (including ideas about lightning), validation of indigenous knowledge, cultural heritage and dignity, and arguments against inclusion. The numbers of responses in each category and per group are indicated in Table 1.

Technology-Related Issues

Sixty-nine (23 %) of the 294 participants in the science sample noted agricultural activities; starting fire using stones; brewing of traditional beer (*umqombothi*); the use of limestone (*kalika*) for dyeing traditional materials, for example blankets and as house paint, and for purifying water; traditional plowing and construction methods; and traditional sources of energy (grass, wood, and cow dung).

Examples of the responses are:

> Limestone (*umbola*, *kalika*) is used for dyeing traditional blankets. (Teacher)
> Dried cow dung can be used as a lamp. (Pupil)
> Preparation to build a rondhavel and '*ukisika inxuwa* (size)—using a pole as a central point and the number of strides (*iinyawo*) which is the same as feet to measure. (Community member)

These types of responses suggest knowledge that is more technological in nature than scientific, but which might be used to provide context and

TABLE 1

Teachers', pupils', and community members' responses as per category developed from the data generated

Category	*Teachers (n = 73)*	*Pupils (n = 143)*	*Community members (n = 78)*	*Overall (n = 294)*
Technology	19 (27 %)	30 (21 %)	20 (28 %)	69 (23 %)
Health	15 (21 %)	27 (19 %)	17 (22 %)	59 (20 %)
Witchcraft	26 (36 %)	52 (36 %)	31 (39 %)	109 (37 %)
Validation	16 (22 %)	23 (16 %)	17 (19 %)	56 (19 %)
Culture/heritage	21 (29 %)	31 (22 %)	22 (28 %)	74 (25 %)
Against inclusion	18 (25 %)	30 (21 %)	11 (14 %)	59 (20 %)

interest when teaching science within Southerland's (2000) notion of instructional multicultural science education.

Health-Related Issues and Witchcraft

Health-related issues such as traditional herbal knowledge, extraction of chemicals from plants, mixing of traditional medicines, and HIV/AIDS issues were mentioned by 20 % of the respondents. The majority of the responses in this category related to the use of traditional herbal medicines either collected personally or obtained from traditional healers (*sangomas*). A wide range of respondents from all of the sample sites gave specific examples of herbs and their medicinal use. The effectiveness of these treatments was noted, the reduction of medical costs was emphasized, and the efficacy of "Western" medicine was queried, for example, a young male teacher teaching in a city school stated:

The so-called Western medicine is so expensive. People die every day because they do not have medical aid [health insurance]. Diseases like HIV/AIDS are killing people because of less effort to encourage traditional medicine.

A middle-aged teacher from a rural area wrote:

Many of our indigenous plants are used to brew medicines, for example, the African potato and Aloe plant. People living in urban areas use traditional medicines.

A young from teacher from the Port Elizabeth area reported:

Firstly in olden days we were not dependent on hospitals and doctors …and the death toll was low. Why? Because we were using our own knowledge to cure any illness.

A grade 11 pupil responded that indigenous knowledge should be included in the science curriculum to highlight "the relationship between science and culture e.g. what people of other cultures do to cure illnesses without the use of medicines."

Knowledge and belief about traditional healing suggests that the topic should be interesting to most isiXhosa-speaking children, and discussion and comparison of comparative efficacies could provide context, interest, and opportunities to examine values when examining issues of health in the science curricula. However, when one moves into the realm of the spiritual healing and superstition, one enters the realm of Southerland's *curriculum multicultural science*, with the attendant dilemmas around the attempts to include such notions into what demarcates science as a discipline. For example, slightly more than a quarter of the respondents cited traditional practices to combat weather problems, especially

attracting rain and repelling storms, and water divining. Witchcraft in general was noted by 26 % of those polled, with a further 11 % specifically noting superstitious beliefs about lightning. Apart from being prevalent, similar examples of superstitious beliefs were mentioned across a wide geographic area. These included witches causing harm through spells that killed, made people ill, and calling up lightning to kill people or destroy their property. The need for traditional healers to exorcise bewitched individuals was also widely noted as it is the belief among many tribes and groups in South Africa (Moodie, 1990).

Issues noted in terms of staying safe from lightning during a thunderstorm included keeping shiny objects covered, not watching TV, not washing, not drinking sour milk (a staple item of rural diets), placing wild olive branches before the front door, etc. These beliefs are evidenced by the statements made by a male teacher of many years of experience in urban schools and a grade 9 pupil from a rural area.

> There used to be ways and means of preventing electrocution by avoiding actions like milking cows, eating, washing during thundering. Mirrors should be covered. We must not sleep during thunderstorms. Dogs must stay away from people. Place a wild olive tree in front of the door.
> Grass brooms and indigenous trees like *umnquma* (wild olive) prevent the lightning from striking our house and us. Since standing under a tree is dangerous, but when we carry sticks like *umnquma* it becomes safe.

There is a high incidence of lightning strikes in the Eastern Cape (Meels, 2007), and the importance of teaching about lightning in school in this area is reflected in the following statements. Mr. N, an elderly community member from a remote rural area with a grade 8 level education, said:

> I feel that lightning is important, particularly in summer …. They have to know the dangers of being under a tree when thunderstorms occur …the length of it is attracting the lightning down to them.

A middle-aged community member from a rural district who had a Bachelor's degree in education (but who was no longer a teacher) wrote:

> We need to give knowledge about static electricity and how to protect [against] electric shock. They [must] learn to know the properties of metals.

An urban-based teacher with many years of experience noted that:

> Static electricity occurs naturally and sometimes with harmful effects in our communities. In nature a thunder with lightning occurs during summer months up to and including autumn. There used to be ways and means of preventing electrocution by avoiding actions like milking cows, eating, washing during thundering.

The statements above suggest that not only is lightning of interest but is also a matter of life and death, particularly in the Transkei where many deaths by lightning are reported each year. The statements below reveal attempts at an explanation and suggest a desire for better understandings.

> We should not sleep during a thunderstorm …because when you are sleeping the body temperature becomes high and the lightning can easily strike you.
>
> Grade 9 pupil

> Science teaches us that water is one of the good conductors of electricity …you cannot use watered hands to fix things that conduct electricity like an iron, stove, etc. When running you are sweat[ing] and your body gets wet. That is when you become a good electrical conductor and which makes for the ease of lightning to strike you.
>
> Grade 12 pupil

> People believed that having electricity in rural areas would be dangerous because it will sterilize their cows. I think people need to be taught advantages and disadvantages of electricity.
>
> Grade 12 pupil

The numerous responses suggest a high level of awareness and the importance of lightning in the lives of Xhosa people, and the types of thought that it has engendered, ranging from the practical (carrying *umnquma* sticks and not standing under trees) to witchcraft (calling up lightning), and attempts at an explanation and in providing links to science (references to electrostatics and electrical conductors).

Validation of Knowledge

The notions of testing, explaining, and validating indigenous knowledge were inherent in a number of responses in this study. For example a community member said that:

> It is important because it is being practised in our homes. But I would like to insist that some experiments be done before confirming the idea is good.

Other comments which suggested an interest in investigating the validity of local indigenous knowledge was the suggestion made by Mrs. R, a community member, who wrote:

> I will be glad if it [IK] can be included in this new curriculum in terms of proving it if possible, or else those who know more about it can give clear explanations.

A middle-aged female community member with a grade 12 education stated that she was aware of beliefs about what should be done to prevent lightning striking, but reflected:

I think what is practiced in our homes about lightning needs to be researched, checked and confirmed if it is correct …[to see] …if they really help to prevent lightning and where it really does come from.

A community member from Queenstown noted:

I will be glad if our learners are able to prove what is true out of the IK they know, so that it can be helpful to our communities.

Such expressions of interest in testing IK claims provide a useful point of departure when considering what constitutes scientific validation. Potentially alienating positions of categorizing ideas as scientific versus unscientific could be ameliorated by adopting Smith & Sharman's (1999) approach of characterizing explanations of events as *more* scientific or *less* scientific based on accepted criteria of what is considered to be scientific.

Culture Heritage and Dignity

A frequently expressed reason as to why it is important to include indigenous knowledge in the school curriculum was to remind children of, and develop respect for, their heritage. Mrs. B from a township stated:

This information is important because it is ours, and we must keep it and use it, as it is useful. It must be known and used by the coming generations. Some of this information comes as dreams to people given to them by their ancestors. It means then people must use it to help other people. It broadens our spectrum of knowledge that is there to help us help people.

Culture, heritage, and dignity were emphasized by more than 25 % of the questionnaire responses, with emphasis placed on the value that cultural identity has for restoring dignity and for protecting a heritage which has been demeaned in the past, with the number of responses in each category being fairly evenly distributed between the pupils, teachers, and community members.

A grade 12 pupil from Port Elizabeth stated:

We have reason to be proud of our past, why not show it?

A teacher noted, "building rondavels (traditional circular thatched huts) in a perfect shape forms part of our culture, which should be recognized",

and a community member wrote that "…people survived in the past by using their surroundings, and relying on their own knowledge forms part of Black heritage, which was taken for granted." Another teacher stated, "Imparting indigenous knowledge provides a powerful means of protecting and preserving our heritage and promoting cultural diversity."

The following are excerpts from parents:

> By us revealing that our grandparents and others people too have used their own knowledge to survive, this could set the record straight about Blacks who are labeled as ignorant.
> Learners should learn about indigenous knowledge at school; so that we have something to be proud of and so that we can show the world that we have something worthwhile to contribute.
> Our knowledge of the past was not recorded like other countries did, so because of this we have been looked at as stupid people. By doing this we show that we are not stupid, but that we have something valuable to contribute and that people should be aware of it.

and

> Since man is the artist for the destruction of his heritage only he alone can change this to hold onto the last shred of dignity, which remains.

A male teacher from Port Elizabeth noted:

> We need to know and give honor to what these people have done as they were the pioneers of what we have now. Their methods or activities they performed needs to be remembered and respected. Their myths and stories became a way of life by which we can appreciate them.

These highly emotional calls suggest that, for at least a proportion of the community, the "politics of recognition" is high on their agenda and not something that should be regarded lightly (Hodson, 2009).

Arguments Against Inclusion

While one teacher from Queenstown felt that indigenous knowledge could be introduced "…by drafting and introducing a new science curriculum that is inclusive of all cultural background knowledge and beliefs based on the immediate surroundings and culture" and another felt that it could be used as "background knowledge to introduce new lessons," nearly 20 % of all responses argued against the incorporation of indigenous knowledge in the school curriculum. A teacher stated, "Indigenous knowledge is not going to be of much use to learners as they do not understand how that old knowledge will help them at school." Two grade 11 learners said, respectively, "No, it is not relevant to today's

world" and "Definitely not—how will it help to know anything our grandfathers did." Several respondents stated that indigenous knowledge should be introduced at an early stage (lower grades) by the elders (as opposed to teachers), while another grade 11 pupil simply stated, "No, Lightning is not caused by witches!"

Mrs. W, a community member from Queenstown, wrote, "Technology is too advanced, so there is no need to return the past. If we want to be a First World country then we must think ahead because clinging to the past is just that." Another community member stated:

> I think it is important because it is the way we grew up, but it doesn't necessarily mean we must endorse it to our kids. The change of period means changes of some cultural aspects and beliefs. We endorse witchcraft as natural processes to our kids. As a result they are confused because they are not sure of what exactly is true.

A father of one of the pupils wrote the following:

> Basically the IK has become obsolete because of the changes that have taken place up to this point. Secondly the modern knowledge grew from IK, that is, already the information we have these days was in a way to a certain extent mixed with the IK. Thirdly, where there is a heterogeneous population it becomes difficult to take a particular set of IK because each group has its knowledge.
> Modern knowledge grew in reaction to the insufficient science knowledge. The only efforts needed now are the ones to keep up the modern knowledge by coming up with new knowledge.

While more than 25 % of the respondents noted the cultural dignity aspect of including indigenous knowledge in the curriculum, 20 % argued against its inclusion, highlighting a potentially divisive unexpected outcome of attempting to include what is considered by some to be important knowledge to be included in science curricula. While the above percentage responses for the inclusion or exclusion of indigenous knowledge into the science curriculum were mutually exclusive, recognition of the cultural dignity aspect of recognizing indigenous knowledge at school was not, which may possibly suggest that those who felt that it was not appropriate for inclusion in science might not be opposed to including it under some other descriptor in the school curriculum.

Discussion

The data suggest that there is a general shared awareness amongst the sample used in this study of a number of ideas and issues that could be

classified as isiXhosa indigenous knowledge, for example issues which include technology, health, witchcraft, and lightning. The main reason given for including indigenous knowledge in the school curriculum is related to issues of cultural heritage and dignity. However, there were also strong arguments against including indigenous knowledge in the school science curriculum, and there were no clear indications of links between Xhosa indigenous knowledge and science or how it could contribute to better understandings of the subject other than the notions of relevance and context which were implicit in some statements.

What comes across clearly in the study is the call by one in four respondents for recognition of indigenous knowledge and the clear reasons given for doing so. The roughly equal percentages of the responses from each of the teacher, pupil, and community member groupings ranged from highly emotional expressions to simply noting that indigenous knowledge should be included. The levels of emotion in the writing of some community members, extracts of which have been provided above, bear evidence of the depth of the need by some for rectifying perceived injustices of the past, restoring the value of their cultural identity and dignity, and protecting their heritage which they believe has been demeaned in the past. The responses of the teachers for inclusion were less strong, while those of the learners seemed, in the main, to be more neutral.

Some responses appealed to science to help understand and validate the indigenous knowledge that exists. A number of community members and some teachers appealed for indigenous knowledge to be "tested" so that they could know "what is true"; others noted that indigenous knowledge should not be endorsed uncritically. There was also mention of difficulties when introducing indigenous knowledge to heterogeneous populations. Nearly 20 % of the respondents across the three groups argued against the incorporation of indigenous knowledge in the school curriculum, with the most pointed rejections coming from the pupils. The range of responses gives credence to Hodson's (2009) caveat not to assume that all members of a cultural group should and do share a particular set of views and the restriction of individuality that doing so might create. However, one such example of a widespread competing worldview, as evidenced by this study and other research in Africa, is understandings of the nature of lightning.

Meels (2007) notes that there is a high incidence of lightning strikes in the Eastern Cape and that uneducated, unsheltered, and rural people form a high-risk group. As such, concerns around lightning are widespread throughout the region, with much of the population believing that it can

be called up by witches, directed at individuals, and countered by sangomas (traditional healers)—a belief also held by many science teachers in local schools (Moodie, 1990). The strength of this notion suggests that perhaps this knowledge could be used to bridge the gap between non-mainstream, cultural ways of knowing and "Western" science which respects students' culturally rooted discursive identity (Chinn, Hand & Yore, 2008), for example when teaching electrostatics and electricity at school level or when training science teachers who will teach in classes where Xhosa children are present.

Such attempts can be framed within the contiguity argumentation theory (CAT), which deals with how different or conflicting ideas are consciously resolved (Runes, 1975). CAT incorporates cultural dialectics normally used by people to communicate with people of different cultures to achieve desirable relationships and places particular attention on the context in which they live (Ogunniyi, 2011). It also can be used for identifying cognitive shifts made as contexts change and recognizes five dynamic states that an individual or group may use within various contexts: firstly, namely dominant—which uses the most appropriate context (science laboratory or church service); secondly, suppressed—where one worldview is subordinated to a culturally dominant one; thirdly, assimilated—a worldview capitulates or is supplanted or subsumed by a dominant one (paradigm shifts in science); fourthly, emergent—where new ideas are incorporated in the old (everyday knowledge and learning science); and, finally, equipollent—where distinct worldviews coexist and may exert equal forces on a person's beliefs (religious scientists).

CAT sees the above categories as being dynamic and flexible, suggesting an internal dialogue or argument in an individual's working memory to resolve the conflict between competing thought systems (Ogunniyi, 2011). Aristotelian notions of contiguity underpin the assertion that different ideas and/or worldviews argue with each other to attain a higher level of meaningfulness or consciousness (Augoustinos & Walker, 1999) and, as such, form a hybrid knowledge that does not compromise the essence of what each stands for as a legitimate way of interpreting human experience. The quest for higher levels of meaningfulness is probably an essential argument for the incorporation of indigenous (and everyday) knowledge in science education.

When considering the purpose of including indigenous knowledge in the curriculum, Lubben (2010) notes that it falls within the realms of affect (to motivate students to value their own knowledge and to learn science): curriculum philosophy (making links between science and

everyday life and open opportunities to learn science for action in society), pedagogic strategies (making the curriculum serve the students and provide opportunities to learn relevant science), and cognitive outcomes (to familiarize students with other knowledge systems and allow them to compare different knowledge systems). For example, Swazi teachers identify a hierarchy of different ways of learning material through which they may link everyday experiences into science teaching, which closely relates to Hammer & Elby's (2003) epistemological views of learning science (Dube & Lubben, 2001).

The difficulties and barriers faced by students of non-Western background when learning science, including the clashes in worldview between local culture and the culture of science, have been extensively researched (Malcolm, 2007). Hodson (2009, p. 128) writes that there is an urgent need to equip teachers with the "knowledge, skills, experience and materials to address issues of indigenous knowledge in a culturally sensitive and critical way," but warns of the dangers of tokenism, or being patronizing or "quaint and colorful" at the expense of rigorous academic considerations. Such statements raise questions as to what these rigorous academic considerations are and what criteria indigenous knowledge must meet in order to be reconcilable within the context of science curricula. Hodson (2009, p. 119) appears to provide direction when he states that it "does no one a service" to call traditional knowledge *science* if it does not "fall within the criteria of definition" (p. 119). This statement brings the argument back to the tensions inherent when attempting to introduce indigenous knowledge into science because of its challenges to the demarcation of science, relativist underpinnings, and assumptions of shared views within a cultural group.

As such, when considering issues of competing worldviews and the ability to teach science effectively, Southerland's (2000) question remains: should the response be the provision of instructional multicultural science education to meet diverse needs, interests, aspirations and values, or a multicultural science curriculum which aims at redefining our conception of science? Are calls for recognition, justice, and heritage protection sufficient reason to attempt to re-demarcate science? Conversely, should the rejection of things indigenous by pupils be an equally valid argument not to include them in the curriculum (Horsthemke & Schafer, 2007)? Or is Yore's (2011) suggestion that the focus be on introducing indigenous knowledge as technology (where appropriate) while clearly demarcating the difference between science and technology a better possibility?

Closing Remarks

The differing perspectives of the sample of isiXhosa speakers in this study reflect to a degree the variety of positions held by science educators, researchers, and proponents and non-proponents of the inclusion of indigenous knowledge in science curricula who, to date, do not seem to have been able to propose an overarching mutually acceptable epistemic positioning. As has been the case in the past, this apparent impasse suggests that more critical reflection on the why, what, whether, when, where, and how of reconciling differing worldviews in science classrooms may be required. If these reflections could produce a more easily navigable framework for charting epistemological and ontological positions, and the logical curricular positions they lead to, a better shared understandings of the main pressures for and against inclusion, what is included, why it is included, and how it is included, might possibly ameliorate the sometimes adversarial positioning of protagonists and provide more broadly acceptable local, regional, and national curricula which include non-mainstream, cultural ways of knowing.

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