

The Role of Indigenous/Local Knowledge in Sustaining Environmental Quality and its Implications for Environmental Education Teaching

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Abstract: This study examines strategies, which local people in Southern Botswana use to sustain their environment. Data were collected from ten people of ages ranging from 19-75 years through detailed interviews and open discussion. The participants included 2 traditional leaders, 2 elderly women, 2 elderly men and 4 youth. The wide range of ages represented a sample of people who had a deep knowledge and understanding of the environment. The findings of the study indicate that elders view local knowledge as the backbone for sustaining the environment, while youth view local knowledge as useful but not a scientific way of sustaining the environment. From the elders' perspective, local knowledge concerning the environment should be included in the school curriculum especially environmental education to enable the youth to learn how the environment was sustained and how environmental quality was maintained in the past. It is shown that indigenous knowledge is not lost and environmental quality is maintained so that future generations continue to use the resources sustainably.

Key words: Botswana, environmental education, indigenous/local knowledge, kgotla, sustaining the environment, taboos

INTRODUCTION

Botswana is located in Southern Africa with a population of 1.7 million people (Republic of Botswana, 2001). It lies between Latitudes 18 and 24°S. The Tropic of Capricorn cuts across Botswana. Botswana is a semi-arid country with the Kalahari Desert on the West. It has an unreliable rainfall and consequently a fragile ecosystem. Although Botswana has a harsh environment, its inhabitants have survived for many centuries. Their survival is attributed to their utilization of indigenous or local knowledge to sustain their environment. It has been noted, that indigenous knowledge has for many years preserved the environment (Ndaba *et al.*, 1995; Schapera, 1933).

According to Raselimo (2003) local/indigenous knowledge is "the knowledge that people in a given community has developed over time and continues to develop. It is based on experience, it is adapted to local culture and environment, it is dynamic".

On the other hand, Appleton *et al.* (2006) contends that local/indigenous knowledge is knowledge generated by communities over time, to allow them to understand and cope with agro-ecological and socio-economic environment. Such knowledge-referred to as 'local', 'indigenous' or 'traditional' can be transformed through systematic process of observation, experimentation and adaptation.

Gough (2006) says indigenous knowledge is the local knowledge that is unique to a culture or society. Indigenous knowledge is also known as local knowledge, folk knowledge, people's knowledge, traditional wisdom or traditional science. This knowledge is passed from generation to generation by word of mouth and cultural rituals and has been the basis for agriculture, food preparation, healthcare, education, conservation and the wide range of other activities that sustain a society and its environments in many parts of the world'.

SciDev (2006) defines indigenous knowledge as 'the complex bodies of knowledge, know-how, practices and representations that are maintained and developed by peoples with long histories of close interaction with the natural environment'.

It has been noted that indigenous knowledge is very importance for the survival of the local people because it helps them to preserve and conserve natural resources, hence the improvement of the quality of life of local people. Schapera (1933) indicates that the possession of indigenous environmental knowledge by local people was the key to their survival. He contends "The use of the land and its resources, however, depends not so much upon the natural environment as upon the degree of knowledge and skill that the people possess". Coles (1985) is also of the view that indigenous knowledge was an integral part of the local people and that failing to use it would have led to environmental

disaster. Vanqa (1996) on the other hand asserts that indigenous knowledge among the Batswana (people who live in Botswana) developed out of physical situation and social needs, hence helping them to take care of their environment.

Appleton *et al.* (2006) assert that local/indigenous knowledge has helped local people to develop environmental management systems that helped them to improve the quality of their lives. Furthermore, indigenous knowledge is now recognized as the only knowledge system that is central to the issue of sustainable and equitable development. This is because it is managed by the users and it is also holistic.

Gough (2006) has reported that indigenous knowledge systems provide the wisdom to manage the environments and the environmental ethics to enhance local and relevant knowledge and skills to sustain the environments. Indigenous knowledge is generally environmental knowledge. This knowledge helps people to sustain their environments without jeopardizing their natural resources. The possession of environmental ethics helps people to live in harmony with nature and environment in a sustainable fashion.

Barnhardt and Kawagley (2005) have indicated that indigenous knowledge have sustained environments for millennia even when the environment was undergoing major social upheaval as a result of transformative forces beyond people's control. They contend that indigenous knowledge is in agreement with the new environmental paradigm which calls for sustainable development. They assert that indigenous knowledge is useful in that it helps people to decipher and adapt to the constantly changing patterns of weather and season cycles.

The importance of indigenous knowledge has been recognized world wide. Honor the Earth contends that indigenous knowledge not only preserves our ecosystem for the benefit of generations to come but also restores traditional indigenous values in our communities (<http://www.honorearth.com/ejik.html>). Indigenous knowledge governs our ways of relating to our natural environment and sustains our communities and protects our ecosystem (<http://www.unesco.org/most/bpik2.htm>).

Indigenous knowledge has helped local people to preserve trees and animal species. The local people knew which trees were best trees for production. Furthermore, 'indigenous knowledge has helped the local population avoid the introduction of exogenous species that are less adapted to harsh conditions and this has minimized production failures' (Warren, 1992).

In Botswana, indigenous knowledge is reported to have helped local population to use natural resources sustainably. In support of this statement, Botswana's paper on best practices on indigenous knowledge

contends 'Environmental sustainability is achieved by making better use of natural resources and native trees to decrease soil degradation and desertification' (Bonufacio and Zanini, 1999). Superior phenotypes have been identified using indigenous knowledge. For example, in Botswana with the help of local people sclerocarya birrea tree (morula) has been identified in the area of Mochudi (<http://www.unesco.org/most/bpik2.htm>). This tree is different from other sclerocarya birrea because it produces very sweet fruits (<http://www.unesco.org/most/bpik2.htm>).

The researchers saw the trees but were not aware that they produce fruits of different taste (very sweet, sweet, sour, etc.) but were surprised that the local people told them the one that was the best (very sweet with large fruits and high yields) (<http://www.unesco.org/most/bpik2.htm>). But when the fruits were collected and germinated the researchers found that the information they got from the local population was precise (<http://www.unesco.org/most/bpik2.htm>).

Therefore, indigenous knowledge has been recognized as a phenomenon essential to human development and that crisis that concerns our ecosystem now would have been solved if indigenous knowledge was used (Warren, 1992).

Although researchers praised indigenous knowledge for conserving the environment, it does have limitations (Schepera, 1933; DaSilva, 1994). Some researchers assert that indigenous knowledge is losing ground because there is no congruence between people's beliefs systems and how they behave (Callicott and Ames, 1989). Furthermore, it has been noted that lack of ecocentric philosophical tradition of the indigenous people has led to extensive environmental degradation. To this point, suggestions have been made that for it not to lose ground, it must be used where is relevant and appropriate (Warren, 1992; Schapera, 1933).

DaSilva (1994) had said this about indigenous knowledge:

Admittedly, many traditional practices are no longer sustainable given increasing population, dwindling resources and changing patterns of human settlement, production and consumption. We must be careful not to automatically assume that what is tradition is necessarily sustainable or even desirable. However, we must be equally vigilant against allowing this argument to discredit LEK (Local Environment Knowledge) or TEK (Traditional Environmental Knowledge). Unfortunately, development processes everywhere have often run roughshod over indigenous practices or beliefs. As Redclift points out, "in the course of development, indigenous environmental knowledge is often lost because it becomes less relevant to the new situation and

because it is systematically devalued by the process of speculation around competitive production for the market”.

Ndaba *et al.* (1994) assert that the youth do not value indigenous knowledge because some issues that it raises are not scientific. Schapera (1933) has also indicated that some aspects of indigenous knowledge should be discarded because they do not tally well with Industrial development. Scholars such as Sillitshena and Osafo-Hyimah (1992) are also of the view that traditional knowledge tend to be in conflict with industrial development.

Although the importance of indigenous knowledge is highly recognized by governments and NGOs world wide, there is fear that it is getting lost. Schapera (1933) asserts that indigenous knowledge in Botswana was used extensively before 1855. 1855 is the time when many Europeans arrived in Botswana and began to influence Botswana's ways of life. Furthermore, Schapera contends that “changes in the use of indigenous knowledge were a result of Natives of Bechuanaland contact with the Europeans”.

Gough (2006) tends to agree with Schapera that Western education made indigenous people to discard indigenous environmental knowledge. Gough holds the view that:

Indigenous people have a wide knowledge of the ecosystems in which they live and ways of using natural resources sustainably. However, colonial education systems replaced the practical everyday life aspects of indigenous knowledge and ways of learning. Today, there is a grave risk that much of indigenous knowledge is being lost and, along with it, valuable knowledge about ways of living sustainably both ecologically and socially.

Other scholars, authors, documents too expressed fear that indigenous environmental knowledge is getting lost due to Western education/influence (Barnhardt and Kawagley, 2005; Appleton *et al.*, 2006) <http://www.scidev.net/dossier/index.cfm?fuseaction=dossieritem&dossier=7>; (Warren, 1992). SciDev.Net contends: ‘Awareness of the value of indigenous knowledge-particularly its potential contribution to sustainable development is growing at a time when such knowledge is being threatened as never before’. Barnhardt and Kawagley (2005) blame western science for the decline in the use of indigenous knowledge to safeguard our environments. Unlike western science which emphasizes compartmentalized knowledge which is often decontextualized and taught in detached setting of a classroom, indigenous knowledge is acquired through direct experience to the whole natural environment (Knudtson and Suzuk, 1992).

Kawagley and Barnhardt (2006) assert that scholars throughout the world are now beginning to recognize the importance of indigenous knowledge in saving the environment from total crisis.

Appleton *et al.* (2006) have stated that indigenous knowledge used to be viewed as ‘backward’, ‘static’ and a hindrance to modernization, but it has recently been realized that it is the basis for sustainability.

Realizing that indigenous knowledge is at the risk of being lost, the United Nations Conference on Environment and Development held in June 1992 in Rio de Janeiro assessed the extent to which its loss would affect the environment (Connect, 1996). The participants at the conference observed that indigenous knowledge is likely to be lost because it is passed orally from one generation to another (Warren, 1992). They all agreed that since indigenous knowledge has been useful for conserving the environment, it should be included in the school curriculum. The Rio de Janeiro conference lightened most countries on the crisis that the environment is facing and assured them of conservation of biodiversity (Warren, 1992)

Many scholars at the Rio de Janeiro conference contended that in many developing nations, environmental crisis is worsened by the tendency of ignoring indigenous knowledge in maintaining environmental quality, yet it was important for the survival of the local populations (Connect, 1996). At the Rio de Janeiro conference (called Agenda 21); the participants observed that the status of indigenous knowledge was worrisome.

Warren (1992) concurs

Of equal concern to many world citizens is the uncertain status of the indigenous knowledge that reflects many generations of experience and problem solving by thousands of ethnic groups across the globe. Very little of this knowledge has been recorded, yet, it represents an immensely valuable data base that provides humankind with insights on how numerous communities have interacted with their changing environment including its floral and faunal resources.

Scholars such as Warren (1992) assert that indigenous knowledge could help generate knowledge based on sophisticated understanding of the environment. Warren has also indicated that the new generation continues to survive in their present environment because of indigenous knowledge. Furthermore, he asserts that indigenous knowledge has helped the local population devise mechanisms to conserve and sustain their natural resources. Ndaba *et al.* (1995) have reported that in Botswana, chiefs used to establish community based organizations that serve as

forums for identifying problems and that these problems were dealt with through local level experimentation, innovation and exchange of information with other societies.

Although researchers fear that indigenous knowledge is at the risk of being lost (Ndaba *et al.*, 1995; Warren, 1992), there are some scholars disagree with this view. Mgadla (2003) opines "European education did not make Botswana discard their environmental knowledge". Mgadla argues that local people had attachment to the environment and there was no way they could detach themselves from the environment. Raselimo (2003) has the fear that it will be lost since it is based on elders who are dying.

The elders were the facilitators of indigenous knowledge with their main task being to ensure that indigenous knowledge is to be transformed into action. UNESCO's view is that this type of learning is open learning that indicates that everybody was invited. According to UNESCO/Education-Learning in the community:

The notion of open-learning community sees learning as a group or social activity as opposed to a strictly individual one. Communities of learning can build upon cultural institutions as diverse as the societies to which they belong or can create new forms of cultural expression (<http://portal.unesco.org/education/en/ev.php.URL-ID=19740andURL-DO=DO-TOPICandURL-SECTION=201.html>).

In Botswana, indigenous knowledge has also been disseminated through open learning where elders were in charge of the learning process.

There is need that indigenous knowledge that was previously used to conserve the natural environment of the local population be maintained as 'much of this knowledge is at as much risk of being lost as is the case with biodiversity' (Warren, 1992).

'Our ways of relating to our natural environment is the key to the sustainability of our communities and to protecting the environment of North America' ([Http://www.honorearth.com/ejik.html](http://www.honorearth.com/ejik.html)). Similarly the same philosophical stance has been applied to Botswana for many years. Several scholars have argued that indigenous knowledge could be sustained and transmitted to the new generation through environmental education in the school curriculum (Ndaba *et al.* 1995; Warren, 1992). The essence of environmental education is to utilize non-formal education (local knowledge) and to transmit it to formal education. In this way, indigenous knowledge would not be lost.

The goal of Environmental Education is to ensure that citizens are knowledgeable about their environment. In concert with this perspective, Stapp (2004) contends:

Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to solve these problems and motivated to work toward the solution (<http://www.charityadvantage.com/f2e2/environmentaleducation.asp>)

Outlining the importance of environmental education, the National Environmental Education Advisory Council, Draft Report to US Congress September 2000, states:

Our Nation's future relies on a well-educated public to be wise stewards of the very environment that sustains us, our families and communities and future generations. It is environmental education which can best help us as individuals make complex conceptual connections between economic prosperity, benefits to society, environmental health and our own well-being. Ultimately, the collective wisdom of our citizens gained through education, will be the most compelling and most successful strategy for environmental management (<http://www.charityadvantage.com/f2e2/environmentaleducation.asp>).

The key role played by environmental education in maintaining a quality environment is highly recognized by Botswana government as indicated by the following quotation: "To promote environmental education and awareness necessary to reduce contamination and achieve sustainable development" (Republic of Botswana, 2004).

The strength and the impact of environmental education were once more regained when the Commission on Sustainable Development was set up by the United Nations in 1992. The aim of the Commission was to monitor the progress of the implementation of the objectives of the United Nation's Conference on Environment and Development based on Agenda 21, which called for sustainable development (Fien, 1996). Agenda 21 pleads with the world community to utilize and at the same time protect fragile environments so that future generation could benefit.

Agenda 21 argues that sustainable development could be promoted by increasing citizen's knowledge of managing their resources in an effective way. Agenda 21 asserts that environmental quality and sustainable development could be maintained if citizens are environmentally literate and it is through environmental education that this could be achieved (Fien, 1996). Finger (1989) argues that environmental education should be introduced into the school curriculum at an early age so that children learn responsible environmental behaviors and become environmentally aware, concerned and committed to the environment and its protection. In this way, environmental literacy could be enhanced and sustainability be nourished. Environmental education should become a process of personal development.

Research indicates that environmental literacy could successfully be transmitted to the communities through non-formal environmental education programmes (Finger, 1989).

Some researchers have reported that teaching environmental education using local or indigenous knowledge could enhance environmental quality. DaSilva (1994) asserts that environmental education could be more effective if local knowledge is used in a way that permits its systematic translation to more formal setting without losing intuitive integrity inherent in it. Agenda 21 (Fien, 1996) holds the view that environmental quality could be promoted if communities understand the relationship between sustainable development and how environmental issues were tackled using indigenous knowledge.

DaSilva (1994) has reported that educators and social scientists contend that environmental education should use local knowledge as the basis for discussion, planning and implementation process. The then British Under-Secretary for colonies in 1861 also recognized the importance of indigenous knowledge in sustaining the environment (Ndaba *et al.*, 1995). Ndaba *et al.* (1995) observe that traditional societies possess deep and highly practical knowledge of their environments, which is based on an experience accumulated over many years. It has been observed that many industrial developments, which result in severe environmental problems, are a result of failure and lack of understanding of the valuable traditions and how indigenous people practice their way of life. DaSilva (1994) observes that indigenous knowledge should be included in environmental education because such knowledge contains wisdom to sustain the environment. Witoon (1992) observes that environmental education that is built on local knowledge that is both appropriate and effective for solving current environmental problems must start from the recognition that local people possess wisdom about dealing with their environment. Otherwise how could they have survived for many centuries, or in some cases, millennia?

Meadows (1989) supports the idea of using indigenous knowledge in teaching environmental education because it comes from familiarity, instinct, intuition and emphatic observation of the living world. Other scholars who assert that environmental education programme utilizes indigenous knowledge would help in sustaining the environment.

The concept of sustainable development received worldwide attention in the 1980s (Bathily, 1995; Fien, 1996; Silitshena and Osafo-Gyimah, 1992). Ndaba, Mmusi and Clark (1995) hold the view that sustainable development means using the planet resources in such a

way that those future generations and tomorrow's children will benefit. Agenda 21 (Fien, 1996) says sustainable development takes the environment into account and attempts to promote forms of development based on rational and economically productive ways of exploiting natural resources so as to improve the people's living conditions and at the same time giving them better access to health and education.

Fien (1996) says sustainable development is a way of producing and distributing resources equally to all people without disturbing the ecosystem. Therefore, teaching environmental education with a perspective towards sustainable development would benefit citizens to preserve the environment for future use by future generation (Cantrell and Nganunu, 1992). Botswana environmental education curriculum has sustainable development and indigenous knowledge as its key concepts. Brandt (1987) holds the view that without sustainable development neither peace can be assured nor the environment preserved.

Silitshena and Osafo-Gyimah (1992) assert that sustainable development aims at improving the living standards of the mass of population without necessarily eroding the economic base on which they depend. Botswana has sustainable development as one of its objectives in its National Development Plan (Republic of Botswana, 1979-85). This objective is a testimony to the government's recognition that development cannot be favored at the expense of the environment. Vision 2016, the Botswana vision asserts that sustenance of natural resources has been the basis for survival by Botswana people for many years. This vision says communities have to be involved in the use and preservation of their resources so that they are sustained for future generation. Therefore, the concept of sustainable development is not new to Botswana.

Research indicates that environmental education could be more effective if taught using both local knowledge and western knowledge (Clark *et al.*, 1997; Ibikunle-Johnson, 1989). It is argued that if children understand indigenous knowledge, they will always strive for sustainability and consequently the concept of environmental quality could be enhanced and achieved.

In recognition of the importance of local/indigenous knowledge in maintaining a quality environment, UNESCO launched a program called LINK in 2002 in an effort to ensure that indigenous knowledge is not lost. UNESCO, Education-Local and Indigenous Knowledge Systems in a Global Society contend:

The project's primary goals include:

- Strengthening local community control over processes of ecological, cultural and social change. Synergies between indigenous and scientific knowledge are being explored in order to enhance biological and cultural diversity, reinforce equity in resource governance and strengthen comprehensive cultural, social and environmental impact assessments.
- Revitalizing traditional knowledge transmission with local communities by strengthening ties between elders and youth and evaluating the opportunities and constraints of existing educational frameworks.
- Identifying customary rules and processes that govern knowledge access and control, in order to inform efforts to develop appropriate normative instruments for protecting traditional knowledge (<http://www.portal.unesco/ev.php-URL-ID=1975andURL-DO=DO-TOPIC7URL-SECTION=201.html>).

Therefore, indigenous knowledge should be used as a framework from which environmental quality could be sustained since it promotes responsible environmental behaviors amongst people.

Conceptual framework for the study: The conceptual framework for this study is based on the universal premise that local knowledge has conserved natural resources for years and has contributed to the development of responsible environmental behaviors amongst people. Furthermore, local knowledge has contributed to the maintenance of a quality environment. As a result, researchers report that local knowledge that has sustained the use of resources for years is now losing recognition due to Western education (Barnhardt and Kawagley, 2005; Warren, 1992).

To ensure that local knowledge is not lost, it should be made part of the school curriculum, especially environmental education. Although drastic changes have occurred (scientific and technological developments), some aspects of the local knowledge that are appropriate for sustaining the environment must be taught to the new generation. Therefore, the educator is obliged to study existing knowledge in order to understand how environmental problems were dealt with traditionally (Witoon, 1992). It is recognized that local knowledge has saved the environment in which we now survive.

The objectives of the study: The objectives of this study were three folds: First to investigate people's local

knowledge and its use in sustaining the environment. Secondly to assess the extent to which local knowledge has contributed to the sustenance of the environment. Thirdly, to assess the conditions under which local knowledge could be tapped and incorporated into the curriculum so that every child could be exposed to it.

Specifically, the purpose of the study was to examine how local environmental knowledge possessed by indigenous people in Southern Botswana sustained a quality environment and how it could be utilized in the teaching of environmental education. Some researchers contend that local environmental knowledge should be incorporated into the school curriculum so as to equip children with skills, expertise and strategies which they could use to sustain the environment for future use (Oakes, 1997). In pursuance of this problem, answers were sought to the following research question,

What indigenous environmental knowledge do people in southern Botswana possess and how has it contributed to the sustenance of a quality environment?

Justification of the study: The rate at which our environment is being polluted causes concern. Therefore attempts are being made to ensure that the quality of our environment is maintained. Voluminous literature review reports that before the arrival of the Europeans, our environments were of high quality, but due to rapid industrial developments they got deteriorated. Fien (1996) suggests that the New Environmental Paradigm (sustainable development) should be adopted by the developing countries as they attempt to industrialize. He blamed loss of the use of indigenous knowledge as the main cause of environmental problems.

The researcher was prompted to find out if the use of indigenous knowledge in Southern Botswana has also helped local people to maintain a quality environment and therefore was justified to be included in the environmental education curriculum to give every child the opportunity to be exposed to it.

Motivation to maintain a quality environment is enhanced
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 Environmental Education Teaching using indigenous knowledge = Sustainability
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 Indigenous Knowledge = Base for Environmental Quality

MATERIALS AND METHODS

This research study employed qualitative research approach especially tape recorded interviews.

Instrumentation: Since the study adopted a qualitative research method, it was not easy to design an instrument. However, the researcher's intention was to explore the participants' indigenous environmental knowledge. In a qualitative study, it is not always wise to write down fixed and finalized questions because more questions come out during the interview, as a result the researcher developed open-ended questions which will help him to be more focused. The responses to the questions were written in themes as a means to summarize the materials covered. The tentative instrument designed for this study is as follows:

- Explain in your own words what indigenous environmental knowledge is and what role it plays in maintaining a quality environment.
- Explain how indigenous knowledge has contributed to the conservation of plants and animals.
- Explain how indigenous environmental knowledge has shaped people's environmental behavior.
- Indigenous knowledge has contributed to the emergence of 'taboos' which safeguarded our environments name some environmental taboos and explain how they have contributed to environmental quality.
- In your view, should indigenous environmental knowledge be taught to school children? Support your answer.

Due to the flexibility of qualitative research approach, the researcher expects other questions to emerge during the interview. To validate the instrument, the questions were given to three environmental education lecturers who were also residents of Southern Botswana to check for clarity, ambiguity and relevance. The validators agreed that the questions of the instrument will extract as much information as possible on indigenous environmental knowledge that would help the young generation with knowledge and skills necessary for maintaining a quality environment.

Data collection: Data for this study were collected using tape recorded interviews. The interviews were recorded because they were very long and it was difficult to recapture them. Furthermore, the researcher decided to have a heading to each interview because they will help him to organize data and to retrieve segments that he wanted to review at any time (Merriam, 1998). The heading consisted of six themes namely, Definition of Indigenous Knowledge, Environmental Legislation, Environmental Education, Resource Management, Environmental Sanitation and Agriculture.

As the tape recording was being done, field-notes were also taken. The essence of carrying out two tasks at the same time was to ensure that they supplement each other. The researcher was aware of the limitations of tape recorded interviews. The biggest limitation of this study was that the interviewees felt uncomfortable when being taped-recorded. Although interview questions were written down in the participants' local language, the researcher was not familiar with the tape-recording activities and as such would sometimes switch off the tape recorder before interviewees stop talking. Interpretation of transcribed interviews was also a problem to the researcher. However, as the tape-recording progressed, the researcher gained confidence and skills in the exercise.

Sampling procedures: The researcher chose Southern Botswana as a research site for various reasons. First the researcher is from the South and therefore, knows the norm, rules and customs of people from the south. Secondly the researcher is familiar with Setswana dialects of people from Southern Botswana. Although Botswana is a multiethnic nation, the researcher believes that the information on indigenous knowledge provided by people from the South could safely be generalized to most ethnic groups in Botswana. Schapera (1993) also indicated that indigenous environmental knowledge systems of most people in Botswana were the same.

Six names of villages in Southern Botswana were written down and the researcher was to select three. The names of the 6 villages were Kanye, Molepolole, Lentweletau, Mochudi, Tlokweng and Ramotswa. By random selection and replacement, the researcher chose three villages, namely, Lentsweletau, Tlokweng and Mochudi. The researcher then went to a main *kgotla* (a *kgotla* is a place where people meet when their chiefs want them to discuss issues that will benefit the tribe) to inform the chiefs of the purpose of the study. Chiefs then called their sub-chiefs to the *kgotla* to inform them about the purpose of the study. All sub-chiefs were excited about the study and thanked the researcher for recognizing indigenous knowledge and its importance for contributing to environmental quality in the past. Sub-chiefs then referred the researcher to headmen in different wards. The headmen called elderly people to come and talk to the researcher about indigenous environmental knowledge. In different wards (*dikgotlana*), the researcher was able to talk to two traditional leaders, two elderly men, two elderly women and four youth. In the researcher's view, the sample was a good one because it represented people with a deep knowledge and understanding of indigenous knowledge and how it contributed to environmental

quality. The participants were selected on the basis of age, experience, gender and leadership qualities. The sample also had a very diverse generation. The participants' ages ranged from 19-75 years old. The researcher requested the participants to provide detailed information which will be beneficial to the new and future generation.

Why qualitative research methodology: People who possess indigenous environmental knowledge are those without formal education. In most cases, these people cannot read or write, therefore, a questionnaire in which a Likert scale is used would not be appropriate. However, in cases where the researcher could write the questionnaire in the participants' local language and could read it out for them, it was very likely that the researcher would get appropriate responses, but would have limited responses or would exclude some responses that would enrich the study. In this case, qualitative research method is appropriate because the researcher will get direct responses from the participants. Furthermore, in cases where the researcher needed clarification, there was room to ask for it and if there were issues that were not clear to the researcher, they will be articulated.

In this study, an interview as part of qualitative research approach was adopted because the researcher could not observe behavior, feelings and how the participants interpreted the world around them. Furthermore, interviews are necessary because indigenous knowledge is about the past events and cannot be replicated (Merriam, 1998). In this study, interview was the only way to get data.

The researcher in this study, chose the type of interview called semi-structured because interviewing in qualitative investigations is more open-ended and less structured (Merriam, 1998). Use of semi-structured interview is reported to have enabled researchers to extract as much information as possible in anthropological studies. This view also applies to small scale research studies such as this one.

RESULTS

Data analysis: According to research, data analysis in qualitative research 'is eclectic', that is there is no right way' (Tesch, 1990). Creswell (1994) contends:

Data analysis requires that the researcher be comfortable with developing categories and making comparisons and contrasts. It also requires that the researcher be open to possibilities and see contrary or alternative explanations for the findings.

In this study, the researcher used the tape -recording method of data collection. Merriam (1998) opines 'This practice ensures that everything said is preserved for analysis'. In this study, the researcher adopted the 'narrative analysis' strategy because emphasis is on the stories told by people and how these stories are communicated in the language used to tell them (Merriam, 1998). Since there are no formulas or recipes for the best way to analyze interviews collected from people, the researcher has decided to put the stories under themes rather than having transcribed interviews.

The themes are as follows:

Theme one

Definition of indigenous knowledge by the participants:

Participants almost provided the same understanding of indigenous knowledge. They were of the belief that indigenous knowledge is knowledge that helps people to sustain their environments based on experience and cultural practices.

Mr. Tsitsi summarizes the participants' understanding of indigenous knowledge as follows. 'When you talk about indigenous knowledge, you are talking about knowledge based on experience, environmental and cultural practices. It is very important knowledge that helped different tribes to survive in their environments and to practice responsible environmental behaviors. It is important because it helps us to conserve our natural resources'.

The participants indicated that indigenous knowledge is now losing ground since people who possess it, the elders, are dying. This observation is in agreement with most researchers' views (Barnhardt and Kawagley, 2005; Warren, 1992).

Theme two

Environmental legislation: The subjects of the study believe that environmental quality can only be maintained if environmental laws are enforced. The participants believe that local leaders (chiefs, sub-chiefs) should be given the power to enforce the laws. The participants talked about taboos, especially the ones that would enhance environmental quality. Taboos are rules and regulations that protect environments. Mr. Sebifelo summarized the participants' views on environmental legislation as follows:

There are many taboos which when followed would save our environment. There are taboos dealing with protection of environments, conservation of plants and animals. People were not allowed to cut down trees during the ploughing season. Let us teach our children taboos that conserved our natural resources. Many Batswana

have different totems and these are highly valued. Each totem identifies with a certain animal which is used as an emblem and regarded as a god-protector. It was taboo for a tribe to kill its own totem.

The participants especially the youth complained about lack of enforcement of environmental legislation in Botswana and assert that the enforcement of environmental policies and legislation are the only means by which the quality of our environment could be maintained. The youth contended that taboos are not scientific but they are used by the elders to instill responsible environmental behaviors into people.

Theme three:

Environmental education: The participants assert that the only way to ensure that taboos and indigenous knowledge are not lost is to teach them in schools. Indigenous knowledge is disappearing and it is only in existence in rural areas and is possessed by old-age people. The subjects reported that when old-age people pass away, indigenous knowledge will be lost forever. Furthermore, the participants suggested that textbooks on indigenous knowledge should be written to ensure the knowledge is not lost.

Ms. Tidimalo summarizes the views of the participants on education as follows:

We teach our children about Queen Elizabeth, not about what helped us to survive up to this time. So we should teach our children about indigenous knowledge, we should have it in our environmental education syllabus. I think a subject called indigenous education should be developed and should be compulsory for all our children. It would be good to have such a subject as it will enrich our children with all the knowledge that helped our grandfathers to survive in harsh environments such as ours.

Theme four

Resource management: There is a general feeling amongst the participants that our natural resources are not managed properly and therefore, it would be rather difficult to achieve a quality environment. It is believed that if resources are managed in an indigenous way, they will be conserved. Indigenous knowledge calls for careful management of the resources. Some participants especially the elders, advice that people should not exploit natural resources but rather should co-exist alongside them.

One of the participants, Mmabatho summarizes the indigenous way of managing natural resources as follows:

We must use our resources sustainably so that future generations could also benefit. We have to be very

careful of how we use our resources. If we don't use them carefully, we will face ecological crisis. We get food, medicines and building materials from plants. Wild animals provide us with meat, beautiful skins which we use for our hats. In our culture, we ensure that there is minimum wastage. Indigenous knowledge helped us to develop a comprehensive understanding of plants and animals.

Theme five

Environmental sanitation: The participants observed that our environments are polluted. They indicated that if indigenous ways of keeping the environment clean are put in place then our environments would be clean. The participants were worried about water which they referred to as scarce resource. In their views, water sustains all life and if Botswana drink hygienic water, it would be a great benefit to human dignity. The participants also mentioned the issue of solid wastes management which they labeled as a threat to the lives of Botswana.

Kitso summarized the views held by the participants on environmental sanitation using indigenous knowledge as follows:

Before it started raining, chiefs used to call their people to the kgotla to instruct them to clean all dry water pools at the lands and cattle posts. This was to ensure that when it rains water flows into clean water pools. In villages, sub-chiefs were to ensure that all people in a ward dump garbage in one area. This area was called thotobola (a designated dumping area). If you dump or your children dump rubbish where it was not supposed to be dumped, the chief and your neighborhood would charge you an ox. It was a serious offence to dump garbage all over the place. The powers that chiefs possessed were stripped off and that is why our country is very dirty.

Theme six

Agriculture: The participants in this study reported that in the past people used to predict whether it was going to be a rainy year or not. They reported that the predictions were in most cases correct. These predictions were based on observation of weather patterns, flowering of certain trees (*Boscia albitrunca*). When *Boscia albitrunca* (motlhopi) flowers and bears fruits, people knew that it was going to a good rainy year and farmers will start ploughing. However, if *Grevia bicolor* (*mogwane*) flowers and bears fruits, then people knew that it was going to be a year of drought. This indigenous knowledge was accumulated over many years of experiences and observations.

Spapuana summarized indigenous knowledge which helped farmers plough as follows:

You know Batswana depended entirely on agricultural produce and as a result developed knowledge which they used to predict weather accurately. If it was going to be a rainy year, a swarm of soldier ants will move in a straight line over a long distance. Once we see soldier ants, we knew it was going to be a good year of harvest. There were also some birds which will make some noise which they never make if it was going to be a year of drought. Flowering of certain plants was a sign of a good year. There were also certain ants which used to make sound alerting people that it was going to rain. Our forefathers did not use instruments that are used nowadays, yet they were always accurate in their predictions of rains. We also prayed hard to our God and he answered us with rain. So we had plenty of beans, maize and water melons and sorghum.

DISCUSSION

The responses of participants on the definition of indigenous knowledge show that there is no operational definition of indigenous knowledge, yet it is a well understood concept because local people's survival is based on it. Furthermore, indigenous knowledge is a multicultural concept and as such each ethnic group defines in such a way that it suits their environments and it enhances their survival.

Despite the fact that indigenous/local knowledge has saved the environment for millions of years, educators in Botswana tend to exclude it from the curriculum. The Government of Botswana does not recognize indigenous knowledge as part of formal education. Clearly the wealth of information possessed by the local people could be utilized to sustain the deteriorating environment. In support of this perspective, Schapera (1933) says 'The use of the land and its resources however, depends not so much upon the natural environment as upon the degree of knowledge and skills people possess (p.1) There are environmental messages that are hidden in local/indigenous environmental knowledge that could be tapped to enrich the curriculum.

From the stipulated themes, it is clear that taboos have been effective in sustaining the environment so much that they became laws. Schapera (1933) says 'So much importance is attached to the taboo that it became part of tribal laws'. It has also been reported that taboos have been in use since the emergence of human beings (Oakes, 1997). Taboos are based on observation of the environment over a long period of time. The subjects of the study specifically, the elders reported that taboos have enabled the local people to maintain a quality environment and have actively involved the local people to solve environmental problems for many centuries. From

the responses, further probing of taboos revealed a lot of environmental messages. For example, the killing of wild animals at a specific period was done after years of observations. Wild animals breed during rainy seasons and it would endanger the young ones if hunting were done during the rainy seasons.

On the other hand, the Kori bastard bird was conserved because it lays only two eggs (Ndaba *et al.*, 1995). To ensure that the Kori bastard bird was not eliminated, the local people unanimously agreed that the chief be the only person who should have the right to kill the bird. This consensus was to ensure that the bird does not get extinct. Schapera (1933) also reported that 'protection and preservation of animals through tribal legislation was adequate for protecting and preserving them'. However, when the Europeans ruled the Africans at the end of the nineteenth century, chiefs lost the power, but when the Europeans realized the importance of chiefs in preserving and protecting animals, they went back to them for help. In other words, the Europeans used chiefs to preserve and protect certain animals they feared would get extinct.

Schapera (1933) says 'Towards the end of the nineteenth century the chiefs of various tribes prompted sometimes by the administration had themselves began to pass law protecting certain animals'.

From the extracts, one elder stated the reasons why the pangolin is conserved in Botswana. He said there was a time in Botswana when people suffered from a disease called 'Ngope' (severe nose bleeding). This disease was cured using pangolin's shell. People would burn pangolins shells and would inhale the smoke from the shells and their bleeding would stop. So Batswana killed many pangolins and sold their shells and this led to almost extinction of these creatures. The reason why pangolins are not to be killed is simply to conserve them.

One elderly man in this study reported that some lizards were not to be killed. These included iguana, gecko, house lizards, etc. It was believed that when these animals are killed they would cause strong winds that could damage crops. When probed further, the old man said that the reason why lizards are not to be killed was because they kill flies and if they are killed the number of flies would increase. Houseflies cause diseases and ill-health and therefore if they are not reduced in number, it is likely that people's health would be affected.

The subjects used in this study, also reported that it was a taboo to drag branches of trees on the ground during ploughing season. It is believed that this would bring in hailstones and strong winds. When one of the subjects was probed further, he stated that the ecological reason for this is that grasses are growing and very delicate during the rainy season, so if you drag branches

on grasses they will be killed. Furthermore, some trees were not cut down during rainy season, the reason being that they would bring in bad weather and hailstones.

In support of this view, Schapera (1933) contends:

Formerly, it was also a taboo in every tribe to cut certain trees while young crops were maturing, i.e., from January to April. The people believed that violation of the taboos would lead to the destruction of crops by hail. The idea of taboo seems to be to prevent denudation of the land of such trees through over-zealous cutting. The taboo period apparently gives just enough time for such trees to strengthen and to habitate themselves sufficiently to render a certain amount of thinning out unharmed.

The ecological reason for not cutting certain trees is that they are food for animals and people during drought period, so if they are cut down then animals will die when there is a drought. Motlhopi (*Boscia albitrunca*) tree's roots are nutritious and can be used for coffee. It was for this reason that it was conserved.

Another thing that was mentioned by the subjects of this study which helped in conservation of animals was a totem. Totems are highly valued by Batswana. Raselimo (2003) has reported that Basotho also value totems. Raselimo contends "Each totem identifies with a certain animal, which is used as an emblem and regarded as a god-protector". Batswana also respect their totemic animals and would not eat their meat when they are killed.

Some subjects, especially the youth do not believe that the use of indigenous knowledge is appropriate nowadays. Schapera believes that this influence is a result of the interaction of Batswana with the Europeans and that could lead to the loss of indigenous knowledge. He noted "Changes in the use of indigenous knowledge were a result of Natives of Bechuanaland contact with the Europeans".

Again in supporting the youth's perspective, Schapera (1933) says:

It may be for instance that certain traditional pursuits have to be abandoned. It may also be that technical innovations have made it possible new methods of using the land, new forms of occupation have provided an alternative to living entirely upon the land.

However, Schapera warned that this does not render indigenous knowledge useless. He suggested that indigenous knowledge should be used with great caution.

Although the youth do not see indigenous knowledge as a scientific way of preserving and conserving the environment rather they see it as way of developing people's responsible environmental behavior. Furthermore, the youth tend to think that enforcing of environmental laws is the only way to preserve and sustain the environment for future generation.

The participants were of the view that the best way to ensure that indigenous knowledge is not lost is to include it under environmental education concepts and to teach it using the infusion approach. Since environmental education is 'education about the environment', 'education for the environment', education in the environment', it is believed that teaching environmental education using indigenous knowledge as an instructional approach would promote students' interests. In this way, new generation would also be exposed to it. Paulo Ferere argues that incorporating indigenous knowledge into an educational environment would help students from minorities feel ownership of the knowledge possessed by their grand parents.

The subjects of the study were of the view that natural resources are not managed in a sustainable way. They mentioned that people have turned natural resources into business avenues. For example, thatch grasses are being cut extravagantly, roots of Kalahari Devil's Claws are sold in large quantities and as result people collect them selfishly.

The participants also reported that environmental sanitation is poorly managed. It was observed that Botswana is infested with solid waste disposals such as cans and plastics. It was indicated that the waste management departments in district councils are not effective in promoting proper environmental sanitation. The participants were of the view that chiefs be given the responsibility to be in charge of environmental sanitation. One elderly man mentioned that in the past chiefs used to send regiments out to collect all solid wastes including *dibeela* (dirty clothes thrown where they are not supposed to be) to ensure that the environment is clean. Local people in Botswana shun dirty environments and as such when chiefs call their people to the kgotla, people will come in large numbers and would clean the environments so that when it rains water will flow into clean pools.

The subjects of the study reported that local people used indigenous knowledge to predict weather and their predictions always helped them to plough crops that will survive the predicted weather. They suggested that weather people should work hand in hand with people who possess indigenous knowledge on weather conditions so that predictions that are made are based on both Western and Traditional Sciences. The participants also reported that indigenous ways of farming were appropriate, since fields were ploughed for a few years that left to fallow so that they can gain fertility. In Southern Botswana people used indigenous knowledge to start ploughing and this helped them to have good harvests.

Implications for teaching environmental education: The subjects of the study especially the elders are concerned about loss of indigenous knowledge and consequently have suggested that it should be included in the school curriculum especially environmental education. However, teaching environmental education using indigenous knowledge has implications. First there are several ethnic groups in Botswana each with its own language. This means indigenous knowledge should be taught using different ethnic languages. This has implications for teaching resources including personnel. Teaching materials will be meaningful to children if written in different languages. This will require a lot of financial support for materials.

In addition, the personnel for teaching environmental education using indigenous will have to be trained. At the moment, Botswana does not have trained personnel to infuse indigenous knowledge concepts into environmental education teaching.

Secondly, there are different languages spoken in Botswana. It is a well established fact that children learn better in their mother tongue. If children are taught indigenous knowledge concepts in their mother tongue, they will feel ownership of indigenous knowledge. The problem that we have in Botswana is worsened by the fact that we do not have specialists in both language and environmental education.

Thirdly, there is no policy document on the teaching of environmental education, so it will be difficult for those who are delegated with the responsibility of teaching environmental education to articulate ways of infusing indigenous knowledge into environmental education concepts. A policy document on environmental education which articulates the infusion of indigenous knowledge into environmental education should be developed. Unless there is a policy document on environmental education that articulates the usefulness of local knowledge, it may difficult to conserve natural resources for use by future generation.

Indigenous knowledge should be made an integral of part of environmental education guidelines of the Department of Curriculum Development and Evaluation in the Ministry of Education if government considers it essential and does not want to lose it. Therefore, the only way to sustain the environment is to teach environmental education to the young people with an emphasis on responsible environmental behaviors using indigenous knowledge instructions which should include environmental ethics to strengthen responsible environmental behaviors.

CONCLUSION

One thing that came out clearly in this study is lack of enforcement of environmental legislation, especially the one on solid waste disposals. Botswana Government officers delegated with the responsibility of waste management tend to be reluctant to enforce environmental legislation. Consequently, it cannot be expected that a quality environment will be maintained.

From the youth point of view, indigenous knowledge, especially taboos are not scientific, but are useful since elderly people still adhere to them and understand them better. However, due to industrial development, some taboos have become irrelevant and should also be reviewed so that they suit the existing situation. It must be noted, that indigenous knowledge is dynamic and it is changing with time. We have a proverb in Botswana which says 'Se sa feleng se a tlhola' which literally translates into 'Nothing on earth remains constant, things are changing all the time'. In view of the fact that indigenous knowledge has saved our environments for many years and that elders still believe in it, it would be appropriate to use both indigenous and Western education simultaneously when teaching environmental education concepts. Some elders believe that indigenous knowledge can be maintained if the young people go to initiation schools where emphasize is on environmental knowledge, respect for the environment, good manners, obedience to the elders and hospitality to visitors (Vanqa, 1996).

The subjects of the study indicated that chiefs would play a significant role in the conservation and protection of the environment. The responsibility to preserve and protect animals and certain plants that was taken from them should again be given to them if environmental quality is to be maintained. The powers of chiefs over their own people are much stronger and if they are used, the environment will be sustained successfully. Botswana believe strongly in what their chiefs say (Ndaba *et al.*, 1995).

RECOMMENDATIONS

There is a general observation that indigenous knowledge is getting lost. To ensure its continuity, Botswana scholars (social scientists, environmentalists) should write a handbook of indigenous knowledge so that the new generations have access to indigenous knowledge and its importance for sustaining the environment.

Since this study covered Southern Botswana only, it would be appropriate that a comprehensive study is conducted to cover all districts in Botswana, so that all ethnic groups are represented.

It is the feeling of the public that the responsibility of maintaining a quality environment is given to chiefs. There is some evidence to suggest that before chiefs were stripped off their power of enforcing environmental legislation our environments were of high quality (Ndaba *et al.*, 1995).

Indigenous knowledge should be incorporated into environmental education so that every child is exposed to it. In addition, teacher training institutions should train their pre-service student teachers in teaching environmental education using indigenous knowledge as a mode of instruction.

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