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The Needed Categories of Indigenous Knowledge Systems in Natural Science Curriculum in South Africa: Narratives from Pongola Schools

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Abstract: *For centuries, South African education was dominated by colonial practices that devalued Indigenous Knowledge Systems (IKS). To reform education, the CAPS 2012 Natural Science (NS) curriculum documents instruct teachers to use IKS when delivering instruction without specifying the categories that should be used. The study was conducted to gather the views and narratives of participants on IKS categories that should be incorporated into the NS curriculum. An African renaissance theory that calls for the decolonisation and Africanisation of education guided the study. An interpretivist research philosophy was used to understand the phenomenon from participants' point of view, and through the use of a qualitative approach, data was gathered directly from participants in their natural settings in Pongola schools. A case study design allowed the researcher to focus on selected schools and collect in-depth information from purposively selected Principals, NS Heads of Departments and teachers through interviews and focus group discussions. Data were analysed and presented narratively and verbatim under emerging themes. Findings revealed that participants advocated for the incorporation of the following six IKS categories into the NS curriculum, traditional veterinary medicines, traditional diets and food processing, traditional medicines, weather forecast, environmental and disaster management, traditional values, uBuntu lenhlonipho (humility and respect). The study recommended that the Department of Basic Education review its policy and incorporate IKS into the Natural Science curriculum as a full knowledge strand. The 6 IKS categories suggested by participants should form a firm foundation and background for the incorporation process.*

Keywords: Indigenous Knowledge Systems (IKS), Categories of IKS, Natural science curriculum, Africanisation, Phongola schools.

1. Introduction

During the protracted colonial and apartheid rule, IKS was denigrated and discarded in the South African education system. Ntuli (1999) argues that in South Africa, colonial masters thought the Western traditions of knowing, intolerant of other traditions of knowing were the best. They believed that Africa was a continent without knowledge and civilisation before colonisation. Such arrogant attitudes suppressed and subjugated IKS to ridicule, resulting in the distortion of the South African socio-cultural and economic development for the majority. Hays (2007) states that in Africa's formal education systems, IKS were devalued, and students who possessed such knowledge were considered incompetent. Mabasa-Manganyi and Ntshangase (2021) call for the decolonisation of the curriculum content in the South African basic education and higher education sector as a whole. The South African education system must not just be South African because it is applied in South Africa but should also be Afrocentric and embrace the African worldview more than any other views that came from elsewhere. Academic institutions must be like baptism rivers where people get baptised with Afrocentrism so that those who return to their homes after acquiring that education arrive there with an Afrocentric taste (Mabasa-Manganyi & Ntshangase, 2021). In many countries, formal education continues to be Eurocentric in outlook, reflecting Western scientific cultures rather than the cultures of learners and teachers. This is a major concern in developing countries, where formal education does not consider the way the majorities of learners think, communicate and learn. The underachievement of learners in school has been attributed to the cultural gaps between the expectations of the school curriculum and environmental expectations where learners are socialised (Abah, Mashebe & Denuga, 2015).

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The South African government made a productive decision by enacting the 2006 Indigenous Knowledge Systems Policy. This policy serves as a legal instrument that recognises and protects Indigenous Knowledge Systems (IKS) in the country (IKS Policy, 2006). In line with the IKS 2006 policy, the Department of Basic Education (DBE), through its Curriculum and Policy Statement (CAPS) 2012 Natural Science (NS) curriculum documents, instructed teachers to use IKS when delivering knowledge in class (CAPS 2012). These curriculum documents do not state IKS categories or content that NS teachers should incorporate in class. For standard and national incorporation of IKS into the official NS school curriculum, the DBE was supposed to explicitly state the categories of IKS that NS teachers should incorporate when delivering instruction. Failure to do so poses a big risk that NS teachers might end up using their own discretion or ignoring IKS.

To corroborate the need for IKS incorporation in the entire African continent, several researchers, academics and governments have gained massive interest in IKS. Altieri (1995) describes IKS as local and natural knowledge forms that have failed to die despite arrogant racial and colonial onslaughts that they have suffered at the hands of western imperialism. Hay (2007) says that IKS refers to traditional, local, or environmental knowledge. These terms point to the type of knowledge whose origin is peculiar to a group of people in a particular environment. Abah et al. (2015) argue that IKS is local knowledge unique to a particular culture and local people acquire it through the accumulation of experiences, informal experiments and understanding of a given cultural environment. IKS includes technology, socio-economic, philosophical, learning, scientific and governance systems of the society. Above assertions indicate that IKS is broad. It is of interest that IKS also encompasses science and technology categories that are key in the 21st century NS school curriculum.

In the case of South Africa, though the CAPS 2012 NS curriculum documents do not indicate the IKS categories that NS teachers should use, the South Africa IKS Policy of 2006 indicates extensive categories of IKS ranging from agricultural practices and health interventions to cultural and religious ceremonies. Chapter 1, paragraph 4 of the IKS 2006 lists IKS categories as health and agriculture, art, music, religion and theology, justice and governance. Hays (2007) and Masemula's (2013) categories of IKS are arts and languages, craft, music and dance, tourism, tracking of animals, health, food and nutrition, biodiversity, environment, ethnoveterinary, civil education, economy and innovation. IKS categories are vast and diverse. None of the categories indicated above are mentioned in the CAPS 2012 NS curriculum documents or comprehensively covered in the official NS study material of 2022. Based on the above lacuna, the study was conducted in Phongola schools to establish categories of IKS that should be incorporated into the official NS curriculum.

1.1 Research Question

To respond to the above problem, the following question was raised to guide the study:

- What categories of IKS could be incorporated into the formal NS curriculum?

1.2 Theoretical framework

To adequately address the guiding question, the study was situated within the African renaissance theory whose vision of development is an all-embracing concept that draws its inspiration from Africa's rich and diverse history and cultures (Jana, 2001). The African renaissance theory provides a framework for modern Africa to re-emerge as a significant partner in the global community. Matunhu (2011) views the African renaissance theory as founded on African norms and values of Ubuntu that are the very building blocks of African life. Kessel (2001) argues that logic dictates that only Africans can understand, declare, initiate, implement, lead, and commit themselves to development through following the principles of African renaissance theory. Jana (2001) emphasises that Africa as a continent was well developed before Western imperialists invaded and distorted the continent's development. When colonial oppressors from the Netherlands, Britain, German, Portugal, France and others docked at several ports along the vast African coast, they came across rich cultures of people. They met a continent with cultures that had developed great sophistication in Arts, Mathematics, and Medical Sciences. The greatest and oldest universities in the world were in the African continent at that time (Jana (2001). The African renaissance is a credible framework that can be used to decolonise education through utilisation of IKS to revive the glory days of Africa that colonial imperialists destroyed.

Jana (2001) argues that for the African continent to achieve social, economic growth and poverty alleviation, sustainable people-centred development must be vigorously pursued, and Africa should take the lead in determining the path and direction for the advancement of the continent's needs and interests. Africa as a continent should work out solutions to the continent's challenges. Matunhu (2011) notes that conceptions of the nature and purpose of development and strategies for achieving them in post-colonial Africa are still dominated by non-African social scientists and researchers who believe that all forms of development in Africa should look to the West instead of using solutions generated from Africa's own local knowledge systems. Hays (2007), Masemula (2013), Matunhu (2011) view IKS as a vital ingredient in the development, advancement and reform of the formal school curriculum. IKS forms the foundation of what learners already know from their communities, making it easy to teach from the known to the unknown as per the dictates of a constructivist approach to teaching and learning. The CAPS (2012) NS curriculum documents adopted constructivism and called for a learner-centred approach in schools. Teaching and learning can only be learner-centered if the curriculum content is composed of the knowledge system that learners know and is relevant to their social contexts.

IKS has more relevance in communities where learners come from than Western knowledge; hence the African renaissance theory calls for the development of the continent through its rich local knowledge systems. Since education is the heart of development Mabasa-Manganyi and Ntshangase (2021) call for the decolonisation of the South African curriculum content of courses and subjects in basic education and the higher education sector. IKS incorporation into the school curriculum is a vital initiative that can decolonise and reform education and make it relevant to the South African and African contexts. The African renaissance theory is about reclaiming the African identity and values, engaging people to face issues of justice, inequality, and sustainability from a collective or communal approach (Matunhu, 2011; Jana, 2001). This theory made it possible to generate IKS categories from Africans who know the knowledge that can reform education and pave the way for Afrocentric development driven by Africa's IKS.

2. Methodology

The study was driven by an interpretivist research philosophy. This made it possible to understand the incorporation of IKS into the NS curriculum from the participants' views and narratives in the field in Pongola schools KwaZulu Natal Province. An intepretivist research paradigm enables researchers to understand the world from participants' perspectives (Tichapondwa, 2013). The use of an intepretivist research paradigm allowed the researcher to use a qualitative research approach. This enabled him to go physically to the field in Phongola schools and gather participants' views on which IKS categories should be incorporated into the NS curriculum. A qualitative research approach allows researchers to collect data directly from participants in their natural settings (Tichapondwa, 2013). A case study research design was employed. McMillan and Schumacher (2014) assert that a case study design allows the researcher to focus on the selected case and gain an in-depth understanding of the phenomenon. This design enabled the researcher to concentrate on five selected schools in Pongola and gathered detailed information on categories of IKS needed for incorporation into the NS curriculum. Principals, Natural Science heads of departments (HODs) and Natural Science teachers were purposively selected to participate in the study. They were considered information-rich participants since they implemented the NS curriculum on a daily basis in Pongola schools. Principals were interviewed while NS HODs and NS teachers participated in focus group discussions. Interviews and focus group discussions generated comprehensive information from participants on IKS categories that should be incorporated into the official NS curriculum. McMillan and Schumacher (2014) view focus group discussions and interviews as effective in gathering comprehensive data from participants. Data were analysed thematically through coding, categorisation and interpretation (McMillan & Schumacher, 2014). Also, research ethics were observed. The study was approved by the KwaZulu Natal Department of Basic Education Ref: 2/4/8/1254. Participants signed consent forms with ethical guidelines before participating in the study. Code names were used to protect the identity of participants and their schools.

3. Research Findings

The study was conducted in Phongola schools to establish categories of IKS that should be incorporated into the official NS curriculum. When responding to the question: Which categories of IKS could be

incorporated into the formal NS curriculum? Participants came up with six categories that were vital to the NS curriculum. Participants went beyond just mentioning those categories to justify the need for their incorporation into the NS curriculum. The six categories given by participants were:

- Traditional veterinary medicines
- Traditional diets and food processing
- Traditional medicines
- Weather forecast
- Environmental and disaster management
- Traditional values, ubuntu lenhlonipho (humility and respect)

3.1 Traditional veterinary medicines

During interviews and focus group discussions, most participants in Phongola schools said that when they grew up in villages, they never saw domestic animals like cows, sheep and goats taken to veterinary hospitals for treatment. They argued that in most communities, veterinary doctors were not even known. Domestic animals were treated by villagers using traditional veterinary medicines. HOD 1 from School A said:

> *In our villages, domestic animals were never taken to veterinary doctors for treatment but were treated locally. Communities stand to benefit if the Department of Basic Education incorporates indigenous ways of treating domestic animals into the NS curriculum. In communities, a goat or cow suffering from indigestion is treated using a concoction of crushed inhlaba (aloe) mixed with water. The dosage is a 750ml bottle filled with the concoction. The bottle is inserted into the animal's mouth on the side where there are no teeth.*

Teacher 1 from school A said that the cow would crash the bottle if it was inserted on the side where there are teeth. He proceeded to say:

> *If the cow does not want to drink, you should tease its oesophagus and it will reflexively drink the medicine.*

At School A, Teacher 1, Teacher 2 and HOD 1 explained how creative indigenous ways are used to treat a cow suffering from umkhonywana (black leg/quarter). Teacher 1 said:

> *After diagnosis, water is boiled up to boiling point. The cow's infected leg is covered with a sack or thick cloth to protect the skin from extreme temperatures of hot water. Black leg always attacks one front leg of a cow at a time. After covering the front leg, boiling water is poured on the infected part.*

HOD 1 said:

> *Once boiling water is poured on the infected part, the cow jumps and instant healing happens. The bacteria that causes black leg accrues on one front leg is called umkhono. This is why this disease is called umkhonywana, and it is believed that this bacteria dies under high temperatures.* When hot *water is poured on the affected leg, it instantly kills the bacteria resulting in instant and amazing healing of the cow. I used the words it is believed because some people erroneously think that indigenous knowledge is not scientifically tested, so it is a belief that it works.*

Abah, Moshebe and Denuga (2015) condemn people who denigrate and portray IKS as unscientific.

Natural Sciences teachers from school A exalted indigenous methods of treating domestic animals. Teacher 2 said:

> *Just imagine only hot water treating a dangerous disease without taking the cow to expensive veterinary doctors. Taking the cow to the veterinary doctor requires transport money and paying the doctor. After all the efforts and payments, there is no guarantee that the cow will be healed. It might still die because arranging for transport and getting the services of the veterinary doctor take time. If the cow dies, it's a triple loss to the owner. Using traditional*

> *ways guarantees maximum success. Hot water heals the cow perfectly without the owner spending even a cent…*

These teachers reiterated that traditional methods of treating domestic animals should be taught in the NS subject to benefit learners.

HOD 1 from School A said:

> *Traditional methods of treating domestic animals are scientifically proven. In African societies, veterinary science has successfully dealt with scientific veterinary challenges from time immemorial.*

Bah (2017) states that the Fulani concept of animal disease and treatment in Sierra Leone closely parallels that of Western veterinary medicines. Participants argued that if indigenous veterinary knowledge is incorporated into the NS curriculum, students would be motivated to research further and document this valuable knowledge.

Pitikoe's (2017) study in Lesotho indicated that the Basotho herders diagnosed ailing livestock and cured them using traditional herbs. The curative potential of some traditional herbs necessitates documenting Lesotho-specific herding IKS and the extent to which such medicines could be applied in other places where livestock herding is part of economic activities. Teaching traditional veterinary medicines in the NS curriculum would assist South African communities in improving the animal husbandry business. Principal 1 from School E said that animal husbandry farmers had used traditional veterinary medicines to treat and maintain their herds of cattle and goats from time immemorial. She noted that this knowledge should be documented and taught in schools to younger generations before elders who possess it die. She said:

> *If this valuable knowledge of traditional veterinary medicines is not taught to our children in schools, it will disappear when elders who possess it die.*

The findings of Bah's (2017) study in Sierra Leone revealed that African farmers have used traditional veterinary medicines to treat their domestic animals from time immemorial. Martin (2003) notes that IKS and technologies in Southern and Eastern Africa are used as a sustainable way of improving animal health as they address erratic supply and unaffordable veterinary services and drugs.

Principal 1 from School E said:

> *Traditional veterinary medicines should be taught in the NS curriculum so that this valuable knowledge can be passed generationally to learners.*

HOD 1 from School E raised a similar point as School A's Teacher 1 and Teacher 2 that in villages, farmers are able to treat any ailment affecting their domestic animals. He spelt out that such knowledge should be passed on undiluted to children. HOD 1 said:

> *Kulezinsuku (these days) valuable information can be shared through the curriculum ngoba (because) abantwana (children) spend more time at school than at home. Most of them no longer know these things, as they no longer have time to learn from elders in their villages. For example, during the rainy season, goats develop soars and wounds, umlotha (ash) is used to treat these. Yes! Ash, from fire. The ash is applied to the wound, and after a few days the wound heals. Remember that ash is produced by different types of trees with different healing powers.*

The HOD went on to give another example of a tree that has healing powers.

> *The Transvaal Kooboo umbovana bark has powers to treat worms in calves. Children need to be taught this knowledge that is readily available in villages because they will grow up to be farmers and need it to treat their domestic animals. Nowadays everything is learnt at school, since children spend more time at school than in their villages.*

The HOD went further to give another example:

> *Even ukufa kwezinkukhu kwelapheka kalula nge SiNtu (chicken diseases are treated easily using traditional ways). Inhlaba (aloe) juice is mixed with water and given to chickens to drink, and they get healed.*

He said that bird flu, coccidiosis, and Newcastle are some chicken diseases that are treated using inhlaba. He urged curriculum developers and education policymakers to include this information in the science curriculum. Teacher 2 from School E mentioned ichena as another traditional medicine used to treat a range of chicken diseases and to chase snakes away from the foul run.

Martin (2003) commends African farmers for using traditional veterinary medicines than relying on expensive Western medications that are sometimes ineffective. Participants noted that in villages, Western veterinary medicines were expensive and scarce, while effective traditional veterinary medicines are readily available at no cost. Participants argued that since traditional veterinary medicines are indispensable in treating domestic animals, it is necessary to include them in the curriculum to empower learners who are future farmers. Participants further noted that incorporating traditional veterinary medicines into the NS curriculum would motivate learners to like school because the curriculum would be relevant to their lived experiences in villages.

3.2 Traditional diets, food processing and preservation

When responding to the question: Which categories of IKS should be incorporated into the NS curriculum? Principal 1 from School E Said:

> *Traditional foods, ngoba kulezinto abantwana abangasazazi ngokudla kweSiNtu (because there are things that children no longer know about traditional foods).*

Participants in Phongola schools said that traditional diets, food processing, and preservation should be included in the NS curriculum. At school B, Principal 1 emphasised that schools should teach learners how to gather, prepare and preserve traditional foods because traditional foods are healthier than Western foods that are produced under artificial conditions. He that:

> *In our villages, we have healthy traditional foods such as obhatata (sweet potatoes), inkobe (A mixture of cooked dry maize, ground nuts, beans, round nuts, or all). Imbuya (traditional vegetable), and pumpkins. Schools should teach children all these kinds of healthy diets.*

The principal continued to say that at school, children should be taught about a balanced diet. He commended a healthy diet in assisting in the fight against diseases in societies. He said:

> *….. these days, we have serious health problems because of what people eat. There are problems of high blood pressure and diabetes. Such kinds of diseases were unknown in the olden days when people used to eat healthy traditional foods, not Western GMOs that are eaten these days. So, if children are taught about these healthy traditional diets …. they will be able to preserve them and be motivated to stick to healthy traditional diets. Diseases will be reduced in societies if people eat healthy diets.*

A study conducted by Ghosh-Jerath, Singh, Kamboj, Goldberg, and Melina (2015) in India proved that indigenous traditional foods have high nutritional value. This is also supported by the statement of participants. In School B, HOD 1 and Teacher 1 called for the incorporation of traditional diets into the NS curriculum. HOD 1 said that:

> *Abantwana kumele bafundiswe (children should be taught) how traditional foods are prepared, processed and preserved. The problem is that we don't take our own knowledge seriously. We tend to wait for someone to come from Europe and tell us that our knowledge is important. Europeans will never do that. Look at what European investors have done. They have stolen our traditional foods and are selling them in their restaurants at higher prices. Inkukhu yemakhaya (a rural chicken), for instance, is very expensive in restaurants because of its high nutritive value than Western broilers*

The HOD continued to say that:

> *Our traditional foods are nutritious, thus why they are in high demand and expensive in restaurants. They fetch a lot of money in the market. Schools should not deprive our children of this valuable knowledge.*

Teacher 1 from School B argued that schools should also teach children the value traditional diets add to the human body. She said:

> *Children should be taught at school what traditional foods do to our bodies. For example, okra makes human joints healthy and flexible. It saves cartilage in the joints like knees. Amakhowa (mushrooms) prevent cancer. Umqombothi (traditional opaque beer) cures running stomach and ulcers. Inkakha (a bitter traditional vegetable) cures high blood pressure (HBP). Wild fruits like amanumbela, umkhuhlu, and amathunduluka are also part of the traditional foods that boost the immune system and cure certain illnesses.*

This teacher argued that failure to promote traditional diets in the school curriculum has resulted in declining household usage to the detriment of good health in African communities. She further argued that many people nowadays eat Western diets promoted by the school curriculum at the expense of traditional diets. She noted that once schools include traditional diets in the curriculum, their usage rate would increase in communities because people tend to use the information taught at school. She believed that traditional foods have a high nutritive value that strengthens the immune system, and their high uptake rate would reduce diseases and ailments in communities. The participant's views are supported by World Bank (2004); Masemula (2013), who assert that traditional vegetables like cassava leaves, sweet potato leaves, and amaranthus have a high nutritive value that is good for human health.

Participants at school A also advocated for the inclusion of traditional foods in the school curriculum. HOD 1 at School A said that children should be taught how traditional foods are prepared and processed in the NS curriculum. He said:

> *Children should be taught in the Natural Science subject how traditional foods like biltong, cassava leaves, cassava roots and ugume are processed and preserved because this process is scientific.*

HOD 1 and Teacher 2 said that ugume is prepared by crushing roasted dry maize into mealie meal. The produced mealie meal can be eaten by licking it (ukuyikhuma), or it can be mixed with water and eaten as thin porridge, or it can be used to bake cakes. Teacher 2 said that miners carry ugume prepared by their mothers or wives and eat it along the way when they travel long distances from their villages back to their workplaces in mines. HOD 1 said that he was craving ugume, and once he visited his village, he would ask his mother to prepare it for him.

Zanini (2002) posits that locals possess skills and knowledge in processing and preserving traditional foods. Elderly African women are the custodians of IKS and technological practices of drying fruits, vegetables and edible insects. Participants emphasised that the school curriculum should document information on traditional food gathering, preparation, processing and preservation so that this knowledge could be passed on to the next generations. At School C and School D, participants asserted that traditional alcohol brewing is full chemistry that deserves to be included in the NS curriculum. They said that the inclusion of traditional foods in the NS curriculum would enrich and make it relevant to learners' experiences in their communities.

3.3 Traditional Medicines and Health

Participants in Phongola schools said that traditional medicines could be a good and relevant topic in the NS curriculum. They said that Western medicines are expensive and inaccessible, and in rural areas, health facilities are located far away from people, but traditional medicines are readily available within their environment. The researcher observed that most rural Phongola villages had no medical centres such as clinics and hospitals close to settlements. Participants said that if the curriculum could empower children with the knowledge of identifying, preparing, and using traditional medicines, health services would improve in communities.

At school C and school, A HODs and teachers argued that children should be taught different types of plants and roots used to treat diseases. Teacher 1 at School C said many plants, roots, and fruits have healing powers. He asserted that:

> *Diseases can be reduced in communities if schools can teach children traditional plants that cure diseases because these plants are available in abundance in their communities. For example, the African potato cures STIs and other diseases affecting people. Uchuchuza (black jack) cures STIs also. Its leaves are crushed and mixed with bathing water to cure STIs such as syphilis and gonorrhoea.*

Landazuri, Chimorro and Cortes (2017) assert that traditional medicines are used to heal different kinds of diseases in communities.

HOD 1 from School C said that ishashaza is used to cure sore throat. He said:

> *Even milk is used to treat certain diseases. Milk is healthy, especially goat milk, but it is also used to treat diseases that affect people. The problem is that most people nowadays no longer know that because these things are not taught at schools and most people have adopted Western lifestyles and abandoned our traditional ways. Women's breast milk, for instance, is used to cure eyes, and donkey milk is used to cure tuberculosis and asthma.*

The HOD argued that traditional medicines and health are broad and relevant fields that children are supposed to be taught at school. He said that public health activities like circumcision practised in societies should be taught in the NS subject and be linked to health and hygiene. Teacher 2 from the same school asserted that rich IKS in public health should be taught in the science curriculum. She said:

> *Ababelethisi (traditional midwives) help women to deliver successfully in villages. Asebophe kakhulu (those who bleed too much during delivery) know what to administer traditionally.*

In support of this assertion Teacher 1 from School C said that hospitals and medical centres ask some traditional midwives to assist in their facilities due to the shortage of qualified midwives. The participant said that traditional midwives possess vast knowledge and skills, including inducing labour if necessary. Ngoma and Siachapha (2017) posit that studies conducted in Ghana, Tanzania, Nigeria, Zambia, and Zimbabwe revealed that in most rural villages, women deliver at their homes with the assistance of traditional midwives. Findings of these studies also showed that some pregnant women in villages use traditional herbs to induce labour if there is a need to. Participants said that the NS curriculum should incorporate all this vast traditional knowledge under a new IKS knowledge strand. Teacher 2 at School A said:

> *Elders in our villages know a lot of plants and trees that are used to treat different diseases. They know which ones are good for treatment and which ones are poisonous. They also know the dosage, whether the patient should take the tip of a spoon, half spoon …. half glass or full glass…. It is not true that traditional medicines are administered without measurements.*

This participant argued that accusations that traditional medicines have no dosages originate from Western countries with a long history of looking down on African practices. She lamented that Western imperialists have polarised some Africans into believing that Western knowledge is better than African IKS. She viewed such people as conditioned to depend on Westerners unnecessarily, even on issues that they can effectively handle by themselves. She noted that traditional medicines cure diseases better than Western medicines and have no side effects that Western medicines have. She said:

> *As Africans, we should stop depending on Western countries and come up with our own African ways to deal with health challenges. Our traditional medicines are much better than Western medicines. Only Africans have been conditioned to depend on Western countries. They look down upon themselves. They don't believe that they can come up with better solutions to their health problems than those solutions imposed on them by Western countries.*

The African Renaissance theory supports the participant's views. Matunhu (2013) and Jana (2002) argue that the African Renaissance theory calls for the use of Afro-based solutions derived from local knowledge in communities as opposed to the use of out-of-context solutions imposed by Western

imperialists. If traditional medicines are promoted in the school curriculum, communities would be empowered to use their own traditional medicines rather than relying on expensive Western medicines with side effects.

Participants argued that, since children no longer spend much time in their villages where they could be taught about trees and plants that cure ailments, then schools have a responsibility to impart the knowledge of traditional medicines to them through a formal curriculum.

HOD 1 at School A named some traditional plants and the types of diseases they cure. He said:

> *In villages, elders know various types of plants that cure different diseases. Like umfengwana (stangeria areograss) roots are used to treat internal parasites. Intolwane roots are boiled and given to cows to treat mange ukusha kwesikhumba senkomo (burning of the cow's skin), inhlungunyembe's (Bushman poison) roots are crushed and used to treat worms.*

Principal 1 at school B also noted that Bushman poison was used to treat worms. He argued that deworming was a good exercise, especially in villages with no access to clean water. Teacher 1 at School A joined HOD 1 to explain traditional medicines and the diseases they cure. Teacher 1 said:

> *The barks of umkwakwa are used to treat a running stomach. The patient chews the barks and treatment occurs. …… donkey dung is burnt and someone suffering from a headache inhales its smoke and the headache gets cured.*

Landazuri et al. (2017) argue that a high percentage of the world's people use traditional herbal medicines for primary health care. Traditional medicines are readily available at a low cost in societies, with better acceptability and lesser side effects than Western drugs.

HOD 1 added traditional medicines used to treat diseases in societies.

> *…. ikati plant is used to treat injuries and soars. Its leaves are crushed and the produced juice is dripped on the wound, then the wound is healed. Pure rural bee honey is used to cure asthmatic, coughing, chest pain and dry throat. Amaxolo amaganu lentanga zakhona kwelapha ama ulcers (the barks and seeds of amarula tree are used to cure ulcers). Jinseng from the Khoi San and Khoi Khoi communities gives energy like red bull is doing now. People use it when travelling long distances. Ichena chases away snakes. Isibiba senyoka chases away snakes and cures snake bites. Uphephetha (bush tea) is a traditional African plant. The problem is that education came with Westerners who promoted their knowledge and excluded our own valuable indigenous knowledge.*

HOD 1 and teacher 1 from school A said that traditional medicines should be taught in science because they deal with Public Health where the government is struggling to deliver satisfactory service to people. They noted that empowering children with knowledge of using traditional medicines would improve health service delivery in societies through the use of indigenous medicines that children learn at school. Abah et al. (2015) validate participants' assertion by arguing that indigenous Africans rely on plant and animal-based medicines to meet their health care needs like other indigenous people elsewhere.

Participants believed that if learners are taught indigenous medicines and health in schools, they would be able to better appreciate and understand health and sanitation. At school B, Principal 1 said that the DBE, through its NS CAPS 2012 curriculum documents, instructed teachers to teach learners from what they already know. He viewed traditional medicines as forming learners' prior knowledge. Ekeke (2016, p.4) argues that "indigenous education enhances educational effectiveness by providing an education that adheres to an indigenous person's own inherent perspectives, experiences, language and customs."

Jana (2001) argues that African IKS existed for thousands of years with its own education system long before European colonisers and missionaries introduced western education. The purpose, content and processes of knowledge transmission of Western education conflicted with those of indigenous education practised in learners' societies and homes. To deal with these challenges, the African renaissance theory calls for the use of IKS to restore African identity and values (Matunhu, 2011; Jana, 2001). The incorporation of IKS categories into the NS curriculum would decolonise it and make it gain

traction with the needs of learners and societies. Mabasa-Manganyi and Ntshangase (2021) call for the decolonisation of the South African curriculum content.

3.4 Weather forecast

Principal 1 from School E said that the environment where learners come from is a weather station in its own right. She argued that indigenous ways of weather forecasting and interpretation should be incorporated into the NS curriculum. She said such incorporation could only be possible if the DBE reviews its policy and embraces IKS in NS as a full knowledge strand. At School B, Principal 1 said:

> *Learners already know indigenous ways of forecasting and interpreting weather, and if this topic is included in NS, it will enable them to use their prior knowledge.*

Participants said that local people use certain signs to interpret weather, like the appearance of certain species of animals, plants, birds and trees producing flowers. They said that when animals like bucks produce a lot of young ones, it shows that there would be much rain that particular year. Risiro, Mashoks, Tshuma and Rurinda (2012) argue that African people have indigenous ways of forecasting and interpreting weather using certain signs from animals, birds and trees. The presence of stock birds and the breeding of goats indicate the beginning of the rain season. The appearance of many quail birds marks the winter season arrival. The laying of eggs by guinea fowls marks the beginning of the summer season.

Participants said that incorporating traditional ways of forecasting weather into the NS curriculum would make the curriculum relevant, especially to learners from rural areas. They argued that the curriculum needs to be relevant to the environment where learners come from if it is to serve its purpose. HOD 1 from School A said:

> *... the NS curriculum forces us to teach Western science that, in most cases, does not address the needs and interests of rural learners. …. If indigenous ways of weather forecast are introduced into the NS curriculum, then the needs and interests of rural children that the formal curriculum has neglected for a long time will be addressed.*

The HOD continued to argue that:

> *In addition to interpreting weather using traditional knowledge, traditional leaders in communities also know how to influence the weather using their ways. For example, virgin girls were taken up the mountain to pray for the rain in the olden days if the rain did not fall during its season. On their heads, they carried indigenous food like ukhamba with beer inside. This food was left up in the mountain. While they were up the mountain, they prayed to God and their ancestors for rain. Remember that traditionally, there is a coalition between God and ancestors. This ceremony was called umkhosi kaNomkhubulwayo. After this ceremony, rain fell.*

Teacher 2 from the same school added that:

> *It was called umkhosi kaNomkhubulwayo, umkhosi oxotsha indlala lesikhonyane. It was done when there was drought, and it was a prayer to God for rains and a better harvest.*

They said that before white colonisers came to disturb, African people had their own good ways of life. It was, therefore, high time for IKS to be embraced in the formal science curriculum in South Africa due to its value and relevance to the daily lives of millions of people in communities. Kamara (2003) confirms that in South Africa, local communities use IKS for survival and to predict the weather for Agricultural purposes. The researcher observed that in most Phongola schools, learners came from rural areas with no televisions and newspapers to give them weather forecast results. Traditional ways of weather forecast remained the only available option for them. Based on this scenario, one would argue that teaching learners Western ways of weather forecasting in isolation from traditional ones is out of context.

3.5 Environmental and Disaster Management

Participants said that traditional methods of managing the environment and disasters should be incorporated into the NS curriculum. At School C, HOD 1 argued that in the NS syllabus, learners should be taught traditional methods of managing the environment and detecting and managing natural disasters.

At school D, Principal 1 said that nowadays, environmental management is vital in societies. He noted that communities possess vast knowledge in preservations of trees and plants, forests, prevention and control of pollution and soil erosion. He said that kind of knowledge should be taught in the NS curriculum to produce learners who are capable of managing the environment and disasters in their societies. He said:

> *There are various traditional ways of managing disasters like famine, droughts and floods. …. our elders in villages possess enormous knowledge of predicting natural disasters, preparing for them, and managing them…. Schools should teach our children such knowledge and skills so that this knowledge does not become extinct once elders die. The government in-fact should document this knowledge because it surely benefits the government…. If communities join hands with the government to manage the environment and disasters, it becomes effective and cheaper for the government.*

The principal proceeded to argue that there are several traditional ways of predicting natural disasters that should be documented and taught in schools. At School D Teacher 1 and Teacher 2 said that certain signs signal the coming of natural disasters; for example, the colour of the moon, especially if certain parts are painted red indicates impending wars. Non-appearance of certain plants and animals, and drying up of certain swamps and pools in rivers that have never dried up before, indicating the coming of drought. The appearance of certain plants, birds, stars, signal excessive rains and floods. Kamara (2003) asserts that communities predict and manage natural disasters. Chikaire, Osuagwa, Ihenacho, Oguegbuchulam, Ejiogu-Osuagwu, and Obi (2012) posit that in 1999 in Budapest, the world conference on science recommended that scientific and traditional knowledge be integrated into interdisciplinary projects dealing with links between culture, environment and development in areas like management of natural resources, conservation of biological diversity, understanding of natural hazards and mitigation of their impact. The beginning point for knowledge systems integration is in the school curriculum. Madlela (2018) called for the incorporation of IKS as a complete subject in the NS curriculum. Such a move would make it possible for IKS to coexist with Western science and be used jointly to solve problems because no single knowledge system is adequate to solve complex issues and challenges affecting communities.

Some participants were of the view that traditional values, uBuntu/Botho lenhlonipho (humility and respect), should also be included as a category of IKS in the NS curriculum. They noted that Ubuntu is a core value that learners should be taught through the formal school curriculum. Literature supports the categories of IKS that participants justified its inclusion in the NS curriculum. Ekeke (2015) and Thompson (2017) recognise the six IKS categories that participants deemed essential to incorporate into the NS curriculum. IKS categories go beyond those that were given by the participants. Since IKS is vast and dynamic, other categories could also be incorporated into the NS curriculum in addition to those suggested by participants. Ekeke (2015) and Abah (2015) put forward the following IKS categories, Agriculture, animal husbandry, veterinary medicine, use and management of natural resources, primary health care, poverty alleviation, climatic phenomena, orientation and navigation on land and sea, construction and maintenance of shelter, preservation of food, collection and storage of water.

4. Conclusions and Recommendations

From literature review and the findings of the study, it was concluded that IKS is relevant to the formal NS curriculum and contexts where learners come from in communities. The six IKS categories suggested by participants should be incorporated into the NS curriculum. Those categories are traditional veterinary medicines, traditional diets and food processing, traditional medicines, weather forecast, environmental and disaster management, traditional values, uBuntu lenhlonipho (humility

and respect). In addition to participants' suggestions, the literature review revealed other broad IKS categories that can be incorporated into the NS curriculum. It was also concluded that to successfully incorporate IKS into the NS curriculum, the DoE should review its policy, embrace IKS as a full knowledge strand in NS, conduct research and document IKS in the official NS study material.

Taking the findings of the study into account, the following recommendations were made:

- That the Department of Basic Education should review its policy and incorporate IKS into the formal Natural Science curriculum as a full knowledge strand.
- That the 6 IKS categories suggested by participants could form the firm foundation and background of the incorporation process.
- The DBE should budget, research, and document IKS in NS study material.
- Schools and the DBE should train teachers on incorporating IKS into the NS school curriculum.
- That the schools should engage parents on the incorporation of IKS into the NS curriculum since parents in communities have vast knowledge on IKS.

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