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Techniques and a Model for the Incorporation of Indigenous Knowledge Systems Into the Natural Science Curriculum in Schools

***B Madlela[1]**
[1]Department of Science and Technology Education, University of Johannesburg, South Africa

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ABSTRACT

The study explored the techniques and a model that could be used to incorporate Indigenous Knowledge Systems (IKS) into the Natural Science (NS) curriculum. An interpretivist research philosophy and a qualitative research approach guided the collection of in-depth data from participants in their natural settings in schools. Data was collected from Headmasters through face-to-face interviews using an interview guide, and from NS Heads of Departments (HODs) and NS teachers through a focus group discussion guide. In each of the five selected schools in Pongola, three NS teachers, one Headmaster and one NS HOD participated in the study. This gave a total of twenty-five participants. Findings revealed that though NS Curriculum and Policy Statements (CAPS) 2012 curriculum documents instructs teachers to use IKS in class, these documents do not state which IKS content should be taught. Discretion is left to individual teachers. This poses challenges to teachers as IKS differ across different cultures in the country, and schools did not have IKS study material for teachers and learners. The study recommended that the Department of Basic Education should review its policy and clearly state the content of IKS that should be taught in NS, broaden the scope of parental involvement to include participation in IKS topics and activities, develop a standardised IKS knowledge strand, involve researchers and publishers to produce IKS study material, and adopt the Madlela model as a guiding Framework to incorporate IKS into the NS curriculum as a full knowledge strand.

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INTRODUCTION

Indigenous Knowledge Systems (IKS) existed pre-colonial period and served as social capital that sustained communities for centuries. Cindi (2021) notes that indigenous people have an array of vast knowledge by which they have lived and sustained their livelihoods for ages. African communities have lived by IKS such as traditional medicinal, agricultural, and educational systems for centuries (Cindi, 2021). The South African IKS Act of 2019 states that IKS is a national asset, and a key component of human capital, social cohesion, decolonization, transformation, and sustainable development. In Kaya's (2014) view the history of Africa's Indigenous ways of knowing and knowledge production did not begin with the coming of Western Knowledge Systems (WKS), and their future should not exclusively depend on Western and other worldviews. Cindi (2021) realizes that, despite its value, IKS is not explicitly expressed in the education curriculum. Cindi argues that the impact of colonization and globalization have meant that over time, IKS has been lost and not imparted to younger generations. South Africa IKS Policy of 2006 spells out that during colonial apartheid era IKS

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and its practitioners were suppressed, marginalized, and subjected to ridicule by arrogant white rulers. This resulted in the distortion of the South African cultural and socio-economic development for the majority, and IKS exclusion in the school curriculum.

After African countries including South Africa attained independence, progressives, scholars, and students framed a broader discourse on decolonizing African education by integrating African epistemologies into the formal school curriculum. Research on IKS and its benefits and prospects for the curriculum have become more pronounced, and have been undertaken in Africa, South Africa and globally. Several studies have been conducted by researchers such as Heleta (2016), Madlela (2022), Khupe (2014), Madlela (2017), Mabasa-Manganyi and Ntshangase (2021), and many others calling for the incorporation of IKS into the school curriculum in South Africa and other African states. Adewale's (2023) study recommended that the South African government should review the basic education curriculum and make allowance for practical application of Ubuntu philosophy. Adewale argues that integrating Ubuntu in the curriculum would create an inclusive learning environment that caters for diverse needs of all learners. Ubuntu philosophy is a vital component of IKS. The 2006 IKS Policy calls for the incorporation of IKS in education and the national qualification framework. Cindi (2021) believes that through the education curriculum, IKS may be formally passed on to subsequent generations and preserved. This view is supported by Codamon-Dugyon (2019) who states that the educational sector plays a major role in preserving and transmitting IKS from generation to generation. Despite calls for decolonizing education and incorporating IKS into the curriculum, the Department of Basic Education (DBE) has not yet come up with a clear model or framework of incorporating IKS into the school curriculum. Though the Natural Science (NS) Curriculum and Policy Statement (CAPS) 2012 curriculum documents state that teachers should use IKS when delivering instruction in class, these documents do not have IKS content that should be taught. They also do not have guidelines on how IKS should be incorporated into the NS curriculum in class.

Onyewuchi and Owolabi (2022) say that there is yet no systematic effort to develop effective framework for incorporating indigenous knowledge into the school science curriculum to complement instructional process. This is despite the increasing recognition of the importance of using IKS for contextualization of school science instruction, since IKS forms a critical part of learners' prior experiences and information that they bring to class. Findings of Cindi's (2021) study reveal that though the DBE makes it a requirement to include IKS during instructional delivery, it is the teachers who are at liberty to ensure how this may be done in their classrooms. This compromises curriculum standardization as teachers are likely to handle IKS differently in their classes. There are no specifications on how teachers should include IKS in their lesson plans, and which IKS must be included. There is also no prescribed material from the DBE that specifically relates to IKS that is provided to teachers. There is no unit that is explicitly dedicated to IKS incorporation in schools (Cindi, 2021).

The NS CAPS 2012 curriculum documents only state that teachers should use IKS in class without spelling out IKS content that should be taught in class. IKS is not part of the four knowledge strands in the NS curriculum. Mavuso et al. (2021) realize that though the South African school curriculum policy proposes that the curriculum should be flexible in valuing IKS through its integration into the mainstream curriculum, there have been various concerns that the integration of IKS into the curriculum and in the teaching of subjects does not necessarily happen as it should. Mavuso et al. (2021) however do not focus on how IKS should be best integrated into the mainstream curriculum after noting that it was not properly integrated, rather they examine the role of teachers, subject advisors, Heads of Departments (HODs) in the integration of IKS at the intermediate phase. Kaya and Seleti (2013) state that there has been limited effort among various African scholars to provide their own clear understanding of the concept knowledge based on Africa's own history of ideas and intellectual development. This could provide a strong African indigenous theoretical framework and guidance for the

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development of methodologies of incorporating African ways of knowing and knowledge production into the postcolonial education system. African scholars, however, have written a lot advocating for the inclusion of IKS into the formal school curriculum, and adequately justified the rationale for such inclusion. Madlela (2022) suggests the categories of IKS that can be incorporated into the NS curriculum that include traditional veterinary medicines, traditional medicines, environmental and disaster management etc. Though strong advocacy has been made and continue to be made on the incorporation of IKS into the formal curriculum, the missing link is how IKS can be best incorporated into the school curriculum since most scholars and CAPS 2012 curriculum documents do not clearly spell that out. Since there is no standard framework guiding the incorporation of IKS into the NS curriculum, the study was conducted to come up with techniques and a model for the incorporation of IKS into the NS curriculum in schools. Such a model would assist the DBE and schools to incorporate IKS into the curriculum in a coordinated and standardized manner.

Research Questions

The study was conducted to respond to the following questions:

1. What are indigenous knowledge systems?
2. How can indigenous knowledge systems be incorporated into the NS science curriculum?

Conceptualization and Theoretical Framework

Indigenous Knowledge Systems

It is essential to conceptualize IKS and bring the reader into perspective. Donato-Kinomis (2016) asserts that IKS and practices are local knowledge developed over centuries of experimentation and are passed orally from generation to generation. It was proven to be a perfect scaffold to sustainable development connecting the past, the present and the future. Donato-Kinomis however notes that IKS and practices are at escalating rate of deterioration due to consistent assimilation and loss of interest on these practices by young people. Donato-Kinomis (2016) further states that empirical evidence to showcase the importance of environmental protection and cultural preservation is encouraged. Studies connecting IKS to academic curriculum are regarded to be highly influential in IKS preservation (Donato-Kinomis, 2016). Mapara (2017) asserts that IKS refer to the intellectual activities of indigenous communities spread throughout the world and have almost all witnessed colonization and intentional extermination. It is also known as indigenous technical science which is passed down from one generation to the next, and it is not static as some would like to think. This knowledge is not external, since it is generated from the local environment (Mapara, 2017).

The DBE says that IKS is a body of knowledge embedded in African philosophical thinking and social practices that have evolved over thousands of years. Asakitikpi (2022) states that IKS define African existence since they are the main resources that Africans use to engage among themselves and the environment for their survival and the common good of all. IKS are entrenched in real life experiences which define local people's world view, relations, and practices, creating a system far removed from the Euro-Western orthodox scientific systems (Asakitikpi, 2022). Dandara et al. (2021) and Mphekgwana et al. (2021) allude that the crucial aspect of IKS is that practices are embedded in people's daily lives. They go on to give an example that, when Covid-19 pandemic hit globally, the economies and health care systems in most African countries could not easily cater for the population needs against the pandemic. A number of African communities resorted to indigenous concoctions, herbs, foods and other practices to manage the pandemic. This reveals that people can use their local knowledge systems to successfully deal with challenges that affect them in their communities. If such knowledge systems could be incorporated into the official school curriculum, they would be passed down from generation to generation through the education system and promote the relevance and sustainable contribution of the curriculum.

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Social Constructivist Teaching and Learning Theory

The study was grounded in social constructivist teaching and learning theory. Rohman and Fauziati (2022) state that Vygotsky a Russian psychologist believes that knowledge is socially constructed through interaction with others in a social environment. Vygotsky's theory views culture and language as frameworks that enable humans to communicate, experience, and understand reality (Akpan et al., 2020). Doudin (2016) argues that according to Vygotsky culture and language enhance children's cognitive development and shape the way they perceive the world around them. Madlela (2022) states that both the language and culture are inbuilt in learners' IKS, hence the need to incorporate IKS into the school curriculum. Vygotsky views lifelong development process as dependent on social interaction and social learning as leading to cognitive development. Learning tasks can be performed by learners collaboratively with peers or under guidance of adults like teachers at school or parents at home (Akpan, et al 2020). Parents can offer proper guidance if learners' schoolwork has IKS components that they use in their societies. Kapur (2018) views IKS as promoting a learner centered approach since it fosters learner collaboration and sharing of ideas.

Omodan's (2022) study concluded that adequate implementation of social constructivism could enhance productivity in classrooms. In constructivism culture and the social environment are a theatre where learning takes place, hence the necessity to incorporate IKS into the school curriculum, because learners already possess it. The use of constructivist teaching and learning methods enable learners to build their own knowledge and understanding through interactions of what they already know and believe, with ideas and activities that they come into contact with. Madlela (2022) notes that when children go to school, what they already know and believe in is IKS. IKS and constructivism form a perfect blend in the school curriculum. Once the two are blended, IKS would scaffold learning and enable learners to learn from the known to the unknown and be enabled to actively participate in their own learning and knowledge construction in class.

Nieman and Monyoi (2016) spell out that most constructivists believe that learning should occur in an authentic and realistic setting. Authentic settings are found in communities where learners come from that are rich with IKS that can be used as a scaffold during teaching and learning in class. Doudin (2016) argues that learning should be scaffolded to make it meaningful and successful. IKS is the best scaffold that is relevant to learners since they already possess it before they even go to school. As a result, the inclusionof IKS into the curriculum raises self-esteem and relevancy of the curriculum content to indigenous learners (Banes&Cruz, 2021). In addition, Mavuso et al. (2021) and Kaya and Seleti (2013) express that successful integration of indigenous knowledge into the curriculum is capable of transforming education by giving it a new face and improving its relevance. It is essential that the education becomes relevant to both learners and communities. The study presents a model and techniques that could assist the Departmentof Basic Education to incorporate IKS into the NS curriculum. Successful incorporation would improve the content of the country's education and make it relevant to contextual needs of learners and communities. It would also support the use of a constructivist teaching and learning theory since teachers will use IKS that learners already possess as scaffolds. This would improve learner participation in class as learning would move from IKS scientific concepts that learners already know and progress to new Western Scientific concepts. A linkage of these two knowledge systems would help learners to understand scientific concepts better.

RESEARCH METHOD

An interpretivist research philosophy was used to guide the data collection process. Kivunja and Kuyini (2017) spell out that interpretivism paradigm makes an effort to understand and interpret what participants are thinking and the meaning that they are making of the context. Effort is made to try to understand participants' viewpoint rather than the viewpoint of the

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researcher. Focus is to understand individual participants and how they interpret the world around them. Hence, the key tenet of the Interpretivist paradigm is that reality is socially constructed (Kivunja & Kuyini, 2017). This paradigm enabled the researcher to gain a broader understanding of how IKS could be incorporated into the NS curriculum from the participants' perspectives and developed the Madlela model based on the participants' viewpoints. An interpretivism research paradigm allowed the researcher to employ a qualitative research approach to collect in-depth data directly from participants in their natural settings in Pongola schools (Creswell & Poth, 2016). The case study research design was used to focus on five purposively selected schools in Pongola KwaZulu Natal (KZN) and studied them in detail to gather comprehensive information from participants (McMillan & Schumacher, 2014). The case study design also allowed the researcher to use interviews and focus group discussions to get a detailed account of the phenomenon from participants in real-life contexts (Morgan et al., 2017).

Abawi (2013) says that interviews involve generating data by asking participants questions and recording their responses. McMillan and Schumacher (2014) say that face to face interviews and focus group interviews generate detailed information that provides a deeper understanding of the phenomenon. Focus group discussions were held with NS Heads of Departments (HODs) and NS teachers while Headmasters participated in face-to-face interviews. A focus group discussion guide and the interview guide were used to conduct interviews and focus group discussions with participants. Discussions with participants were guided by the following questions: Give a brief overview of Indigenous Knowledge Systems (IKS)? Which techniques/methods can be used to incorporate IKS into the NS curriculum successfully? Interviews and focus group discussions took place in participants' offices and staffrooms.

Participants were purposively selected on the basis of in-depth information that they possessed about the incorporation of IKS into the NS curriculum. NS teachers and NS HODs as curriculum implementers in schools had first-hand experience on the incorporation of IKS into the NS curriculum. Headmasters were the ones who oversaw the implementation of the curriculum in their schools. As a result, they had vast knowledge about the incorporation of IKS into the NS curriculum. In each school three NS teachers, one Headmaster and one NS HOD were purposively selected to take part in the study. This gave a total of twenty-five participants selected from five schools. Data was analyzed narratively under themes that emerged from data interpretation, and in some cases participants' contributions were presented in a verbatim manner (McMillan & Schumacher, 2014). Research ethics were upheld. Names of schools, and participants' names and identities were not disclosed, and participation in the study was through informed consent. Participants signed consent forms with ethical guidelines before taking part in the study (McMillan & Schumacher, 2014). They were told of their right to discontinue participation at any stage when they wanted to without any victimization. Permission to conduct the study was granted by the Department of Basic Education provincial office in KwaZulu Natal province.

The research procedure was carried out in three phases as illustrated in figure 1.

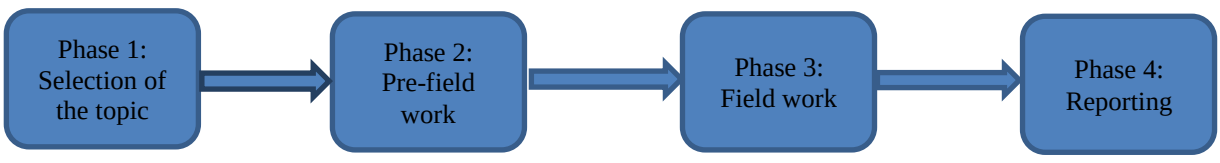


Figure 1. Research flow chart

The research process started with topic selection followed by the pre-field phase where preparations for the field work were done. After permission was granted by the Department of Basic Education to conduct the study in Pongola schools, field mapping was done, and

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appointments were made with participants in the five selected schools. This was followed by the fieldwork phase where data was gathered from purposively selected participants. In the last phase data was analyzed, discussed, and presented.

RESULTS AND DISCUSSION

Two major themes emerged from data analysis and interpretation. These were indigenous knowledge systems and techniques of incorporating IKS into the NS curriculum. Data was analyzed under these two themes. Based on the study's findings and literature review, a Madlela Model for the incorporation of IKS into the NS curriculum was developed.

Indigenous Knowledge Systems

Participants gave impressive explanations of IKS during interviews and focus group discussions. In response to the question, give an overview of IKS, the headmaster at school E said:

> *IKS is ulwazi lweSiNtu (traditional knowledge), into oyaziyo before uye esikolweni (something that you already know before you go to school) for example values, respect, and tolerance.*

Teacher 1 from school A during focus group discussions said:

> *IKS is knowledge based on us people. Knowledge created by us that we did not learn from school, but we proved it ourselves that it works e.g. a Zulu way of refrigerating water in an iselwa container. In our modern life we can say iselwa cools water like refrigerators are doing though water in iselwa is not as cool as in the refrigerator.*

HOD in school D said:

> *IKS is the kind of knowledge that children bring to school from their different communities. This knowledge is deeply rooted in the people's traditional ways of living and survival, for example, the Khoi Khoi people never used hospitals, but they used traditional herbs. Nowadays these herbs have been converted as if they are from Western countries, yet they are purely Africa's indigenous resources. Dagga for instance is an African herb, but Westerners have taken it as if it is theirs and they are using it to manufacture medical drugs. Generational survival skills of the Khoi San people were based on African Indigenous Knowledge.*

HOD in school C said:

> *Indigenous Knowledge is knowledge that has been produced by communities themselves, and it has managed to sustain them from time immemorial. Learners bring this knowledge from their communities to school.*

From participants' responses it is evident that IKS is traditional knowledge constructed by local people themselves in their communities for survival and sustainable development. Children go to school already possessing this knowledge. Participants' views on IKS are supported by Donato-Kinomis (2016) who says that IKS are local knowledge systems developed over centuries and are passed orally generationally. Magni (2016) and Abah et al. (2015) also view IKS as local knowledge unique to a given culture or society. Participants noted that Khoi Khoi people had no hospitals, but they successfully used traditional herbs to deal with their health needs. Though Khoi Khoi people lived long ago and survived through IKS generationally, Dandara et al. (2021) and Mphekgwana et al. (2021) reveal that when Covid-19 pandemic hit across the globe a number of African communities resorted to indigenous concoctions, herbs, foods and other practices to effectively manage the pandemic. This shows that IKS has been successfully used to solve problems in communities from time immemorial up to date.

Techniques of Incorporating IKS Into the NS Curriculum

In response to the question: Which techniques/methods can be used to incorporate IKS into the NS curriculum successfully? Participants stated that there should be a guiding framework for the incorporation of IKS into the curriculum. They raised concerns that the DBE through NS CAPS 2012 curriculum documents just stated that teachers should use IKS while delivering lessons in class without giving details on which IKS content should be used. Discretion was left to individual teachers without a national standardized guiding framework. Participants said that if IKS is to be successfully incorporated into the NS curriculum the DBE should review the education policy and the South African Schools Act, produce IKS study material, involve parents and IKS experts and custodians, standardize and incorporate IKS as a full knowledge strand into the NS curriculum.

Review of Education Policy and the South African Schools Act

Participants at school C and school E said that the review of the DBE policy and the South African Schools Act no 84 of 1996 would set a framework and direction for the incorporation of IKS into the NS curriculum as a full knowledge strand. They said that the schools act should be reviewed so that it could clearly spell out how parents and other relevant stakeholders should be involved in curriculum issues since they are the ones who are experts and custodians of IKS. At school E participants said that for the incorporation of IKS into the formal NS curriculum to succeed, there should be forceful lobbying of the government to review the DBE policy and ensure that it incorporates IKS into the NS curriculum as a full knowledge strand. The headmaster from school E said that for anything to be taught in schools the government should give a go ahead, hence the necessity for policy review to comprehensively embrace IKS.

Teacher 1 from school A said:

> *The Ministry of Basic Education is still sticking to and supporting the policies that promote Western Knowledge Systems while oppressing Indigenous Knowledge Systems.*

The headmaster from school E said:

> *It is difficult for teachers to teach IKS because it is not part of the policy. The Ministry only says that IKS is important, and it must be taught in schools, but there is no policy framework to guide that. Indigenous Knowledge can only be taught in schools in a more structured and systematic manner if the Ministry of Basic Education changes its policies that only support Western Knowledge and incorporate IKS as a key element in those policies.*

Participants noted that without policy clarity IKS could not be successfully incorporated into the NS curriculum. They viewed policy review by the DBE as the only move that could set a framework for the successful incorporation of IKS into the curriculum. Shizha (2013) argues that policy makers in Africa were victims of Western Education policies that exalted Western Knowledge Systems (WKS) and despised IKS, as a result they tend to believe that Western Knowledge is superior to IKS. The DBE's NS CAPS 2012 curriculum documents only state that teachers should use IKS in class, but the syllabus does not have IKS knowledge strand and content. It has four knowledge strands laden with only Western science. Mbembe (2016) realizes that syllabuses that were designed to meet the needs of colonialism and apartheid have been allowed to continue into the liberation era. Billa and Makoge (2019) argue that the African renaissance theory notes that the overall character of much of practice and educational theory in Africa is overwhelmingly Eurocentric, and a reflection of Europe in Africa. The African Renaissance calls for decolonization and recognition of African IKS in education. Madlela (2017) and Msila (2016) spell out that colonization promoted ontological and epistemological realities of the world's most powerful and undermined African ways of knowing. Onyewuchi and Owolabi (2022) note that there is yet no systematic effort to develop an effective framework for

incorporating IKS into the school science curriculum to complement instructional process. This is despite the increasing recognition of the importance of using IKS for contextualization of school science instruction. Participants viewed policy review as one of the techniques that could yield a systematic framework that could guide the incorporation of IKS into the NS curriculum in a coherent manner.

Production of IKS Study Material

Participants said that if the incorporation of IKS into the formal NS curriculum is to be successful, then the DBE should work with schools, communities, and book publishers to document IKS and publish it in official NS textbooks and handbooks. The headmaster at school B said:

> *If Indigenous Knowledge is to be integrated into the Natural Science curriculum, the DBE and publishers should publish books on Indigenous Knowledge for use by teachers and students. The books that are used now do not have information on Indigenous Knowledge.*

Participants said that lack of official IKS study material makes the incorporation of IKS into the formal school curriculum a challenge. Teacher 1 from school A said:

> *Publishers of official study material are failing to research on Indigenous Knowledge Systems. There is really a serious shortage of IKS teaching material. The textbooks that we are currently using to teach NS either have nothing on IKS at all or they have only 2 lines of such information serving as minor case scenarios or examples.*

Participants argued that IKS could only be successfully incorporated into the formal NS curriculum if the government budgets and allocates enough resources for such incorporation. HOD in school D said:

> *The government should come up with a sufficient budget to incorporate IKS into the Natural Science curriculum, to promote IKS centers, research, and to promote IKS custodians in communities.*

The HOD further argued that, without an adequate budget the paucity of resources would prevail and result in the failure to successfully incorporate IKS into the formal NS curriculum. Those sentiments were also raised by the headmaster at school B, who argued that projects in schools usually fail because of lack of adequate resources and funding. He said:

> *Teachers might be willing to incorporate IKS into the curriculum, but if there is no government support in the form of budgets and resources such an initiative is likely to face some challenges.*

Participants emphasized that the availability of IKS study material would motivate teachers and learners to embrace IKS since they would be having sources to refer to for information. Madlela (2023) calls for the documentation of NS IKS study material. Doing so would prevent a situation whereby teachers and learners are only guided by information that has been documented in Western science textbooks. Hoppers (2005) argued that science should not be restricted to Western science but should include the knowledge systems of diverse cultures in different periods of history. They view the recognition of diverse traditions and creativity as an essential component of keeping knowledge systems alive. Based on these assertions it can be said that participants suggested a good technique that the DBE should collaborate with researchers and publishers and produce IKS study material that should be used in school.

Involvement of Parents, IKS Experts, and Custodians

Participants viewed involvement of parents, IKS experts and custodians as one of the effective techniques that could result in the successful incorporation of IKS into the formal NS curriculum. They said that parents should play a pivotal role in the whole incorporation process

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by motivating their children to use IKS and providing necessary IKS resources at their disposal that can be helpful at school. They said that parents could also help children to do homework on IKS related schoolwork and homework. Participants' suggested technique of involving parents to help their children with homework is supported by Vygotsky's constructivist teaching and learning theory. Akpan et al. (2020) assert that in constructivism learners can perform tasks with peers collaboratively or under the guidance of adults like teachers at school and parents at home. Involving parents on IKS related schoolwork and activities would prove effective as most parents in communities are conversant with IKS. Participants felt that if learners are to appreciate and embrace IKS at school, they should be initially encouraged by their parents at home to embrace it. Teacher 2 from school B said:

> *Parents should encourage children to use traditional knowledge and items instead of wasting time on social media discussing non-academic issues.*

Parental involvement and encouragement are supported by Maluleke (2014) who states that parental involvement includes the participation of parents in a wide range of school based and home-based activities to improve their children's education. Parental involvement offers support and encouragement to learners (Maluleke, 2014).

The HOD from school C said:

> *In the OBE (Outcomes Based Curriculum), there was advocacy for parental involvement, but there was no plan as to how parents with Indigenous Knowledge were to be involved. There was no plan, it was not in the formal curriculum, it was informal, and it was not timetabled. The teacher who didn't know a parent could not invite.*

The HOD suggested that parental involvement should be done systematically not haphazardly. He said that if parental involvement is not systematic, then teachers who come from other places and do not know any parent would not benefit from it. He said:

> *Parents' involvement at school should be formal. It should be in the formal curriculum and timetable. The Ministry of Basic Education and schools should work together to identify parents who are experts in Indigenous Knowledge and practices. The South African Schools Act should be amended to broaden the scope of parental involvement in schools.*

Participants said that parents who are experts and custodians of IKS could be used as resource persons and could be invited to school to share IKS information and practices with learners and teachers. Teacher 1 from school A said:

> *Though some parents have been Westernised, and some are too young to be called parents, because some students are ingane zezingane (children of children), but there are some parents like elderly ones in rural areas who are rich in Indigenous Knowledge.*

Participants suggested that those parents who possess IKS information and those who are experts and custodians of IKS such as elders in communities could be used by schools to assist teachers and learners on IKS related topics and activities. Participants' assertions are supported by Mafa and Makuba (2013) who assert that parents can visit schools to assist learners in class on topics where teachers need their help. Thompson et al. (2017) view parental and community involvement as having a positive impact towards the performance of their children at school. Parents and community involvement in school activities such as teaching and learning enriches instructional process by bringing rich local knowledge and skills possessed by different parents to classrooms in schools.

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Standardization and Developing IKS Full Knowledge Strand

Participants noted that IKS had variations in different South African communities, as a result it needed to be standardized and presented in the NS curriculum as a full-fledged knowledge strand. A Headmaster from school B said:

> *Indigenous Knowledge is value and culture based. Practices differ in districts and provinces. These variations might not be understood by learners from different tribes and races. Beliefs and practices differ across tribes and ethnic groups. Diets differ from tribe to tribe, for example, thina lapha KwaZulu (we here in Zululand) we have the best diet. Our diet is balanced, it has vegetables, meat, papa, beans, milk, but other people might refute this and claim that their diet is the best. This would make it difficult to incorporate IKS into the NS curriculum nationally.*

HOD from school C emphasized the necessity of coming up with ways of addressing cultural diversity by the DBE so that IKS could be successfully incorporated into the NS curriculum. He said that the Outcomes Based Curriculum of 2005 tried and failed to incorporate IKS into the school curriculum. He said:

> *The OBE curriculum had organizers. These were big phases and the teacher had to organize the learning content based on the local environment. Localizing the learning content created standardization problems, then the OBE curriculum failed because it couldn't go to grade 10 – 12 due to its lack of standardization. At Matric level students write a standardized national examination. This automatically renders an indigenized local curriculum irrelevant in addressing the needs and requirements of a standardized national examination.*

This participant went on to say that incorporating IKS into the school curriculum poses a dilemma of contextualization versus standardization. He said that the discontinued OBE 2005 curriculum had many books with IKS information for teachers to choose from. Teachers were only choosing information that was relevant to their context. The selective teaching of IKS posed a serious challenge when learners were supposed to write standardized national examinations.

HOD from school C continued to say:

> *If IKS is to be successfully incorporated into the formal school curriculum, the Ministry of Basic Education should research first the failures of the OBE curriculum. In fact, the Ministry made a mistake by changing the curriculum instead of researching and improving it.*

Teacher 1 from school B said:

> *The incorporation of IKS into the OBE curriculum 2005 failed due to lack of stakeholder engagement. IKS was then dropped when the curriculum was revised.*

Participants advised that going forward if IKS is to be successfully incorporated into the school curriculum, the DBE should not pursue such an endeavor alone, but it should engage the whole stakeholder community and collectively come up with appropriate models of incorporating IKS from different cultures and races. Participants said that due to the diversity of IKS in different districts and provinces of the country, it is difficult to incorporate it in class without a clear policy framework from the DBE that spells out which IKS content is supposed to be taught in the NS curriculum. They suggested that the best technique to mitigate such challenges is for the DBE to be inclusive and standardize IKS nationally and present its content in the NS curriculum as a full knowledge strand that covers the whole country's IKS diversity. In Keane's (2017) study in KwaZulu Natal province, teachers argued that their classes had heterogeneous cultures, so whose IKS should they teach. Participants noted that developing an inclusive IKS full knowledge strand by the DBE embracing all cultures in the country could

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standardize IKS content in the NS curriculum, and mitigate the challenges brought by IKS diversity in the country's provinces and classrooms.

Madlela IKS Incorporation Into NS Model

Based on participants' suggestions on the techniques of incorporating IKS into the NS curriculum and standard practices of curriculum development and innovation, a step-by-step Madlela Model detailing how the DBE could successfully incorporate IKS into the NS curriculum was developed. The model consists of six phases that offer guidance on how IKS could be incorporated into the NS curriculum.

Phase 1: Situation/Needs analysis and stakeholder engagement.
Phase 2: Reviewing the Department of Basic Education Policy.
Phase 3: Research and documentation of scientific IKS study material.
Phase 4: Developing a scientific IKS full knowledge strand.
Phase 5: Piloting, Dissemination, and implementation of the innovated NS curriculum.
Phase 6: Monitoring, Evaluation, and Reporting on the new innovation.

Phase 1: Situation/needs analysis and stakeholder engagement

Carl (2017) argues that situation analysis is the beginning phase of curriculum development and innovation that involves collecting and interpreting data that informs the exercise. At this phase the DBE should engage all stakeholders and gather information from them. Participants said that the incorporation of IKS in the OBE curriculum 2005 faced challenges and was discontinued because it was done without engaging relevant stakeholders. After completing this process, the DBE should produce a report based on the gathered information from all stakeholders. Such a report is the one that would inform other phases.

Phase 2: Reviewing the Ministry of Basic Education Policy

Participants said that the education policy only instructs teachers to use IKS in class without spelling out the IKS content that should be taught. Mbembe (2016) notes that colonial syllabuses continue to be taught in the liberation era. The African renaissance theory calls for decolonization of colonial curricular by embracing indigenous knowledge in the school curriculum which is capable of addressing contextual needs and interests of communities. At this phase the DBE through stakeholder consultations should review its policy and give clarity on the IKS content that is supposed to be incorporated into the NS curriculum. Participants said that IKS should be incorporated as a full knowledge stand in the NS curriculum. Madlela (2022) advises the DBE to comprehensively incorporate IKS as a full knowledge stand in the NS curriculum. Once that is done teachers would be guided accordingly as to what exactly should be taught and what time of the year or term should it be taught.

Phase 3: Research and documentation of scientific IKS study material

Since participants said that there was no IKS study material for teachers and learners in schools, at this phase the study material for IKS should be produced. Participants said that the DBE should collaborate with researchers and book publishers to document and produce IKS study material. IKS experts and custodians in communities and other relevant stakeholders could also be involved in this project as a way of parental and community involvement in the school curriculum development. Diwu and Ogunniyi (2012) argue that IKS written material is not readily available to teachers. Most teachers believe that textbooks are not helpful to learners because they contain only a few cultural activities serving as case studies. It is therefore vital that at this phase adequate IKS study material should be produced.

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Phase 4: Developing a scientific IKS full knowledge strand

Based on the needs assessment report, guidelines in the reviewed education policy and the produced KS study material, a full IKS knowledge strand should be developed and incorporated into the NS CAPS 2012 curriculum documents as a fifth knowledge strand. Madlela (2022) argues that IKS should be incorporated into the NS curriculum as a comprehensive full knowledge strand. When developing the IKS knowledge strand the following steps could be followed, formulation of outcomes for the IKS knowledge strand, selection of scientific IKS content, organization of scientific IKS content, evaluating scientific IKS content, selection of learning experiences, classification of learning experiences, testing, and evaluating learning experiences. Table 1 shows the four knowledge strands in the current NS curriculum, and table 2 shows the five knowledge strands in the NS curriculum that the study is advocating for. Western Knowledge Systems on their own are not sufficient to solve vast and diverse needs of African communities, hence the need to incorporate IKS into the curriculum to address context specific realities of African communities.

Table 1. Current NS knowledge strands

Current NS Knowledge Strands
▪ Life and Living ▪ Matter and Materials ▪ Energy and Change ▪ Planet Earth and Beyond

Adapted from CAPS (2012) NS curriculum documents

Table 2. NS knowledge strands after incorporating the IKS strand

Advocated NS Knowledge Strands
▪ Life and Living ▪ Matter and Materials ▪ Energy and Change ▪ Planet Earth and Beyond ▪ Indigenous Knowledge Systems (IKS)

Phase 5: Piloting, dissemination, and implementation of the innovated NS curriculum

Once the innovation of the NS curriculum has been completed, then the innovation should be piloted in few selected schools so that the DBE could check and attend to gaps. After piloting the innovation should be disseminated to all relevant stakeholders followed by training, especially training of teachers and school management team members who are involved in the implementation of the curriculum. Jacobs' (2015) study in Western Cape showed that teachers who were trained in workshops were more confident in class than those who were not trained. This means that training teachers is essential in enabling them to implement the innovated curriculum with confidence. Carl (2017) states that curriculum dissemination gathers familiarization and stakeholder acceptance and support. This leads to its smooth implementation. Once the innovated NS curriculum has been successfully piloted and disseminated, it can then be fully implemented in schools.

Phase 6: Monitoring, evaluation, and reporting on the new innovation

After the innovated NS curriculum has been implemented in schools, the DBE team working in (2017) states that curriculum monitoring and evaluation is essential to curriculum developers and users as it gives them much needed feedback.

Illustration of Madlela Model

The current NS CAPS 2012 curriculum documents have four knowledge strands that are illustrated in the table below. The Madlela Model proposes the fifth knowledge strand

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composed of IKS. This would align with the African renaissance theory that spells out that education and its discourses in Africa should be indigenous-oriented and grounded (Billa and Makoge, 2019). Phase 1 - 6 of the Madlela model give clear guidance on how IKS should be incorporated into the NS curriculum. The model answers the main question of the study: Which techniques and methods can be used to incorporate IKS into the NS science curriculum? The model gives guidance step by step on how IKS could be incorporated into the NS school curriculum. An illustration of the model is given below, and the innovated output is given in table 3.

Madlela IKS Incorporation Into NS Model

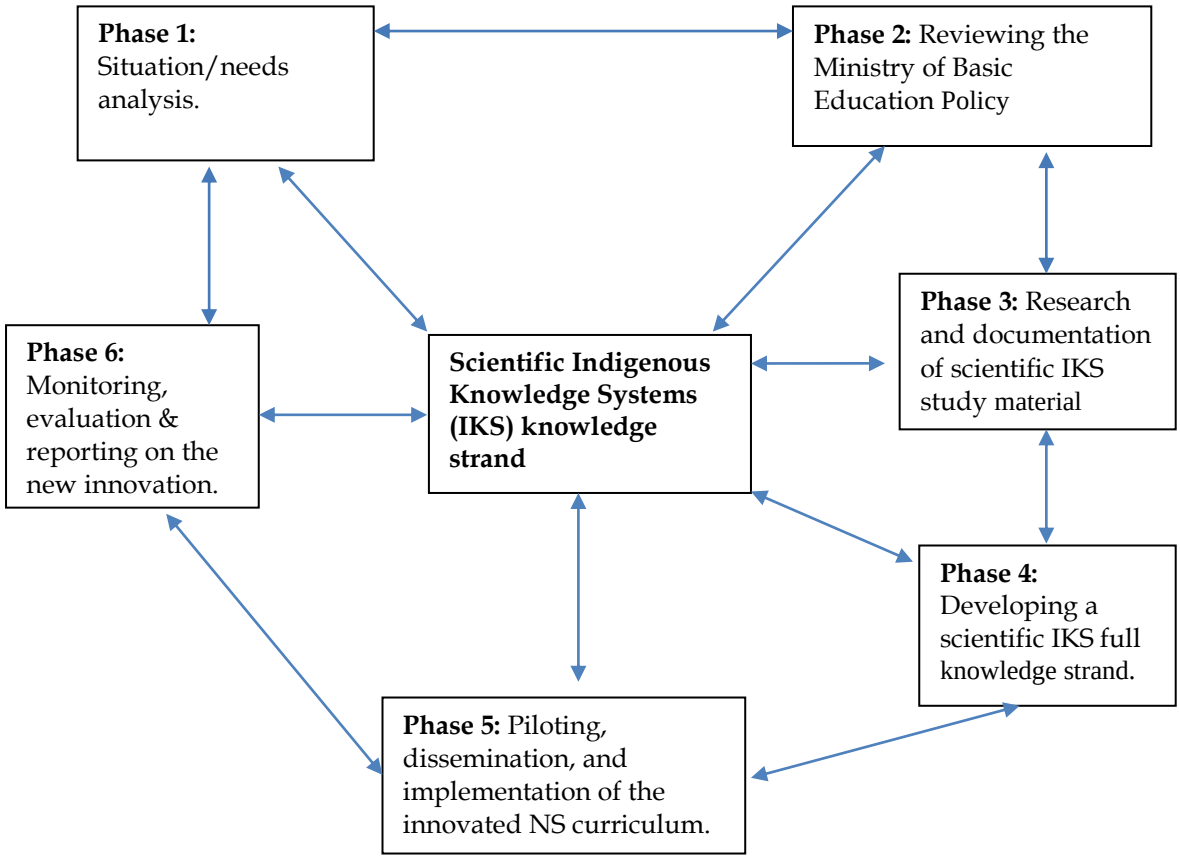


Figure 2. Illustration of Madlela model

Table 3. An innovation output

Natural Science Knowledge Strands	Status
▪ Life and living	Current NS strand
▪ Matter and Materials	Current NS strand
▪ Energy and Change	Current NS strand
▪ Planet Earth and Beyond	Current NS strand
▪ Indigenous Knowledge Systems (IKS)	New NS strand

Table 3 illustrates how the new innovation would look like. Instead of having the current four knowledge strands, the innovated curriculum would have five knowledge strands including the IKS one. Having IKS as a full knowledge strand would advance Levy Vygotsky's constructivist approach to teaching and learning which views the learner's culture and language as pivotal to the learning process (Akpan et al., 2020). IKS forms the foundation of what learners already know that they bring to the classroom. It would also advance the calls by

the African renaissance theory education in Africa should embrace indigenous African worldview (Billa & Makoge, 2019).

CONCLUSION

Based on the study's findings and literature review it was concluded that the DBE's NS CAPS 2012 curriculum documents state that teachers should use IKS when delivering lessons in class. The curriculum documents, however, do not specify which IKS content is supposed to be taught. Discretion is left to individual teachers to choose how to incorporate IKS in their lessons. It was also concluded that cultures differ in the country's different provinces. Therefore, if the incorporation of IKS into the NS curriculum is to be successful the DBE should standardize and develop a full inclusive IKS knowledge strand composed of different IKS information from cultures across the country. This could be possible if the DBE reviews its education policy and clearly states that IKS should be incorporated into the NS curriculum as a full knowledge strand that embraces the cultures found in all the provinces of the country. It was further concluded that the government should come up with a sufficient budget to fund the incorporation of IKS into the formal NS curriculum, and the DBE should work with relevant stakeholders to produce IKS study material.

Another conclusion made was that incorporation of IKS into the formal school curriculum still faced challenges such as non-availability of IKS study material. It was finally concluded that the Madlela model offers clear guidance on how IKS should be incorporated into the formal NS curriculum. If the Department of Basic education adopts it and techniques of incorporating IKS into the NS curriculum that were generated by the study, IKS could be successfully incorporated into the NS curriculum. Based on the study's findings and literature review, it was recommended that the DBE should review its policies and issue clear policy guidelines that IKS should be incorporated into the NS curriculum as a full knowledge strand that is inclusive of the cultures found in all the country's provinces, lobby for the amendment of the South African Schools Act so that it broadens the scope of parental involvement to include the supportive role of parents and IKS experts and custodians in schools on IKS topic and activities, work with stakeholders such as researchers, IKS experts and custodians, parents and book publishers to produce IKS study material for the NS curriculum. It was also recommended that the DBE should adopt the Madlela model and use it as a guiding framework for the incorporation of IKS as a full knowledge strand in the NS curriculum.

AREAS FOR FURTHER RESEARCH

The study was only limited to Pongola schools in KwaZulu Natal Province. Other provinces were not given an opportunity to participate. Further research can be conducted in other provinces or nationally. Further research can also be conducted on the perceptions of teachers and learners on the incorporation of IKS into the formal NS curriculum.

REFERENCES

Abah, J., Mashebe, P., & Denuga, D. D. (2015). Prospect of integrating African indigenous knowledge systems into the teaching of sciences in Africa. *American Journal of Educational Research*, *3*(6), 668-673.

Abawi, K. (2013). Data collection instruments (questionnaire & interview). *Training in Sexual and Reproductive Health Research Geneva*, *1*, 18.

Adewale, S. (2023). Promoting sustainable development goal 5 through Ubuntu-based South African basic education curriculum. *Studies in Learning and Teaching*, *4*(3), 432-443. https://doi.org/10.46627/silet.v4i3.231

Akpan, V. I., Igwe, U. A., Mpamah, I. B. I., & Okoro, C. O. (2020). Social constructivism: Implications on teaching and learning. *British Journal of Education*, *8*(8), 49-56.

Asakitikpi, A. (2022). African indigenous medicines: Towards a holistic healthcare system in Africa. *African Identities*, *20*(4), 365-379.

Banes, G. G., & Cruz, K. B. D. (2021). The integration of Indigenous Knowledge Systems (IKS) in the tertiary level curriculum of Benguet State University La Trinidad campus. *Mountain Journal of Science and Interdisciplinary Research*, *81*(1), 19-36.

Billa, L. J., & Makoge, Y. N. (2019). Curriculum as a key instrument to African Renaissance and subsequent development: Challenges and the way forward. *African Journal of Education and Practice,* 4 (2), 11–20.

Carl, A. E. (2017). *Teacher empowerment through curriculum development: Theory into practice*. Juta and Company Ltd.

Cindi, L. (2021). *Incorporating African indigenous knowledge systems into the basic education curriculum: Experiences from two schools in the Gauteng and KwaZulu-Natal Provinces, South Africa*. University of the Free State.

Codamon-Dugyon, E.M. (2019). Community extension/public service, production and technology. *Proceedings of the Indigenous Peoples Education Conference*. University of the Philippines Baguio.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Dandara, C., Dzobo, K., & Chirikure, S. (2021). COVID-19 pandemic and Africa: From the situation in Zimbabwe to a case for precision herbal medicine. *Omics: A Journal of Integrative Biology*, *25*(4), 209-212.

Diwu, C. T., & Ogunniyi, M. B. (2012). Dialogical argumentation instruction as a catalytic agent for the integration of school science with Indigenous Knowledge Systems. *African Journal of Research in Mathematics, Science and Technology Education*, *16*(3), 333–347. https://doi.org/10.1080/10288457.2012.10740749

Donato-Kinomis, X. G. (2016). Indigenous knowledge systems and practices (IKSPs) in the teaching of science. *13th National Convention on Statistics (NCS)*.

Doudin, Y. M. (2016). *The constructivist theory of learning*. Multimedia University.

Heleta, S. (2016). Decolonisation of higher education: Dismantling epistemic violence and Eurocentrism in South Africa. *Transformation in Higher Education,1* (1). https://doi.org/10.4102/the.v1i1.9

Hoppers, C. A. O. (2005). *Culture, indigenous knowledge and development: The role of the university*. Centre of Education Policy Development of Johannesburg South Africa.

Jacobs, K. R. (2015). *The classroom implementation of indigenous knowledge in the science curriculum by science teachers in the Western Cape province, South Africa* [Doctoral dissertation, University of Cape Town]. OpenUCT. https://open.uct.ac.za/handle/11427/15553

Kapur, R. (2018). The significance of social constructivism in education. *Research Gate.*

Kaya, H. O. (2014). Revitalising African indigenous ways of knowing and knowledge production. *Restoring indigenous self-determination*, *105*.

Kaya, H. O., & Seleti, Y. N. (2013). African indigenous knowledge systems and relevance of higher education in South Africa. *International Education Journal: Comparative Perspectives*, *12*(1), 30-44.

Keane, M. (2017). Why Indigenous Knowledge has a place in the school science curriculum. *Research Gate*.

Khupe. C. (2014). *Indigenous Knowledge and school science: Possibilities for integration* [Doctoral dissertation, University of Witwatersrand]. http://hdl.handle.net/10539/15109

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), 26-41.

Mabasa-Manganyi, R. B., & Ntshangase, M. X. (2021). The path to decoloniality: A proposal for educational system transformation. *Interdisciplinary Journal of Education Research*, 3(1), 56-65. https://doi.org/1051986/ijer-2021.vol3.01.06

Madlela, B. (2017). *Incorporating indigenous knowledge systems into the formal natural science curriculum: A case study of schools in Pongola, KwaZulu Natal Province* [Master's thesis, University of South Africa]. UNISA Institutional Repository. https://hdl.handle.net/10500/28656

Madlela, B. (2022). Blending a constructivist theory of teaching and learning with indigenous knowledge systems in the official natural science curriculum in Pongola schools, Kwazulu Natal. *Indiana Journal of Arts & Literature*, *3*(1), 6-12.

Madlela, B. (2022). The needed categories of Indigenous Knowledge Systems in natural science curriculum in South Africa: Narratives from Pongola schools. *Interdisciplinary Journal of Rural and Community Studies, 4*, 23-35. http://doi.org/10.38140/ijrcs-2022.vol14.03

Madlela, B. (2023). Prospect and challenges of integrating indigenous knowledge systems into the natural science curriculum in schools. *EUREKA: Social and Humanities,*(3), 3-19. https://doi.org/10.21303/2504-5571.2023.002867

Mafa, O., & Makuba, E. (2013). The involvement of parents in the education of their children in Zimbabwe's rural primary schools: The case of Matabeleland north province. *Journal of Research & Method in Education*, *1*(2), 37-43.

Magni, G. (2016). *Indigenous knowledge and implications for sustainable development agenda global education monitoring reports*. United Nations Educational, Scientific and Cultural Organization (UNESCO).

Maluleke, S.G. (2014). *Parental involvement in their children's education in the Vhembe District Limpopo* [Doctoral dissertation,University of South Africa]. UNISA Institutional Repository. http://hdl.handle.net/10500/18814

Mapara, J. (2017). Binarism as a recipe for luke warm research into indigenous knowledge systems in Zimbabwe. In P. Ngulube (Ed.), *Handbook of Research on Theoretical Perspectives on Indigenous Knowledge Systems in Developing Countries* (pp. 1-21). IGI Global. https://doi.org/10.4018/978-1-5225-0833-5.ch001

Mavuso, M. P., Olawale, E., & Mkosi, N. (2021). Integration of indigenous knowledge in the intermediate phase curriculum: A case of South African schools. *Knowledge, Innovation and Enterprise (KIE) Conference, 1*,7-19.

Mbembe, A. (2016). Decolonising the university: New directions. *Arts & Humanities in Higher Education,15*(1), 29–45. https://doi.org/10.1177/1474022215618513

McMillan, J. H., & Schumacher, S. (2015). *Research in education: Evidence-based inquiry*. Pearson.

Morgan, S. J., Pullon, S. R., Macdonald, L. M., McKinlay, E. M., & Gray, B. V. (2017). Case study observational research: A framework for conducting case study research where observation data are the focus. *Qualitative health research, 27*(7), 1060-1068.

Mphekgwana, P. M., Makgahlela, M., & Mothiba, T. M. (2021). Use of traditional medicines to fight COVID-19 during the South African nationwide lockdown: A prevalence study among university students and academic staff. *The Open Public Health Journal*, *14*(1).

Msila, V. (2016). Africanisation of education and the search for relevance and context. In V. Msila&M. T. Gumbo (Eds.), *Africanising the Curriculum: Indigenous perspectives and theories* (pp. 57–69). Sun Press.

Nieman, M. M., & Monyai, R.B. (2016). *The educator as mediator of learning*. Van Schaik Publishers Pretoria.

Omodan, B. I. (2022). The potency of social constructivism on classroom productivity in universities. *Studies in Learning and Teaching*, *3*(1), 36-45. https://doi.org/10.46627/silet.v3i1.97

Onyewuchi, F.A., & Owolabi, T. (2022). Effect of indigenous knowledge systems strategy on secondary school students' performance in physics in Lagos State, Nigeria. *International Journal of Innovative Research& Development*, *11*(1).

Rohman, D., & Fauziati, E. (2022). Gamification of learning in the perspective of constructivism philosophy Lev Vygotsky. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, *5*(1), 4467-4474.

Shizha, E. (2013). Reclaiming our indigenous voices: the problem with post-colonial Sub-Saharan African school curriculum. *Journal of Indigenous Social Development,1*(1).

South African Indigenous Knowledge Systems Act, (2019). Pretoria: Government printers.

Thompson, A. M., Herman, K. C., Stormont, M. A., Reinke, W. M., & Webster-Stratton, C. (2017). Impact of Incredible Years® on teacher perceptions of parental involvement: A latent transition analysis. *Journal of School Psychology*, *62*, 51-65.

Author (s):

*Benkosi Madlela (Corresponding Author)
Department of Science and Technology Education,
University of Johannesburg,
Auckland Park, SouthAfrica
Email: benkosimadlela@gmail.com