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Inculcating IKS cultural practices into the pre-service science and mathematics teacher education curriculum at an Institution of Higher Education in Namibia

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ABSTRACT

In this paper we interrogate the teachers training programme offered at an institution of higher learning in Namibia. We used Empiricism to explore the authentic practices used in the transformational processes exposed to 3rd and 4th year mathematics and science student teachers. We emphasized three important constructs that guide the scholarship of teaching, namely standards of excellence, virtues and values to guide IK integration in the curriculum. We conclude that student teachers understood the meaning and importance of IK. However, the teacher preparation curriculum did not include aspects related to IK, it was left at their own discretion to adopt. We recommend appropriate strategies for adoption to implement and guide the required standards and values for curriculum development.

INTRODUCTION

The dream of inculcating IKS in many African countries is still not realized. In recent years, there has been an increasing interest in the areas of IKS integration in the higher education curriculum. The academic staff feel like foreigners in their own continent as they are still unable to propagate the culture of the Africans both in methods and materials in the science and mathematics education (Abonyi & Achimugu, 2014). A symposium on Science Technology and Innovation (STI) in Africa (2022) recognised the need to promote indigenous knowledge systems (IKS) and to prioritise research that target individual nations needs. Recent developments in Africa have brought about policies and laws to develop science and technology for socio-economic development to improve livelihoods. These policies state science and mathematics as major contributors to national building; personal development through literacy; and subsequently acquisition of an objective mind towards achieving national economic goals. Furthermore, science and mathematics is understood to enhance understanding of social reality and interaction in a world that is increasingly dominated by technological advancement. These developments have called for reforms in science and mathematics education curriculum. In this light, lack of capacity to be able to inculcate IKS in the curriculum. Besides, the curriculum promotes western views to teach science and mathematics and schools have been struggling to convince the educational authorities to implement IKS in the curriculum. Many governments have rushed to expand the infrastructure development, including educational facilities in order to cater for increasing populations. The rapid expansion of these facilities have affected the quality of education delivery in many areas including the demand and supply of teachers of science and mathematics (Ogunniyi & Rollnick, 2015). As a result, many African governments continue to produce inadequate number of mathematics and science teachers. The available few cannot be retained due to a number of factors including poor resources, inadequate number of training institutions among others (Nhalevilo & Ogunniyi, 2011). Ogunniyi & Rollnick (2015) posits that there is little refereed and accessible literature on the importance

of challenges and the effort to which African government need to do in order to achieve quality teacher educational programmes, a need that has been taken for granted by many developing countries. However, current studies revealed that existing instructional approaches are highly particularistic, hopelessly biased and guilty, not only perpetuating a lack of understanding regarding indigenous fields of knowledge and cognition (Abonyi & Achimugu, 2014; Owuor, 2007). The effect of negating IKS in the curriculum may create a disconnect to the student teachers' culture and as modern teachers may result in their loss of direct experience in relation to their culture and consequently those of their students. This paper draws on Empiricism to explore pre-service science and mathematics teachers' authentic practices regarding IK, its inclusion 'in the teacher preparation programme and what they perceived as obstacles to its inclusion in the training programme.

Namibia is a country that was ruled by Germany from 1884 to 1915 after which South Africa took over until 1990 and introduced the apartheid system. The German colonialists invested in opening up trade routes than educating the colonized. Moreover, under the South African ruling, the black population continued to suffer dehumanization for purposes of achieving 'banking education' (Freire, 2020). Thus, learning of mathematics and science in Namibia remained hostile with little relevance to the Bantu population. Throughout the colonial times, schooling was not compulsory and limited to a few elites that served the colonisers. The western mechanistic world view dominated the colonial education system. At the time, the only legitimate way of learning was the western view of nature and science, degenerating African ways of learning (Abah et al., 2015; Mubangizi & Kaya, 2015). As a result, non-western learners coping strategies and reception of western knowledge was not important to the education authority. Activities that promoted foreign language development and or African identity were barred from schools and colleges. Black communities had limited understanding of their rights to education and as a result lacked empowerment socially, economically and culturally. Overtime, some of those educated in the colonial error took up education as a career without sufficient training in the field of education, let alone in science and mathematics. Ironically, the teacher training programmes offered basic competencies in content and pedagogy to enable the teacher to cope with teaching after graduation. This situation remained perpetual until the independence of Namibia that brought about transformation.

After independence in 1990, black communities became empowered to realise their 'sense of dignity' and at least have access to free and quality education including a culturally appropriate education (UNESCO, 2002). However, the definition of a culturally appropriate education for minorities and the marginalised remains elusive (UNESCO, 2002). Brown & Haihambo (2017) argue that the curriculum inherited from the previous government had little relevance to the lives and experiences of most Namibians. Like all other African nations, Namibia followed the call to decolonise and integrate a culturally appropriate curriculum across all schooling programmes with instruction in English over local languages creating much ambiguity in the way teaching is conducted (Brown & Haihambo, 2017; Chavez, 2016). This created an absence of dialogical teaching that hides the true nature of learning and knowing between educators and students (Freire, 2020). Amukugo (2017) posits that the role of education in Namibia should be consistent with post-colonial educational goals that advance social equity including appropriate cultural practices. The Higher Education Curriculum in Namibia negates IKS integration even though evidence is present that the majority of graduates including mathematics and science teachers go to teach in rural schools where resources are scares showing unequitable distribution of resources and as a norm western science is promoted. In order to address this gap in the curriculum, institutions of higher learning ought to teach alternative views that could be applied to address rural problems. Thus, unless a high caliber of science and mathematics teachers are produced in the teacher training institutions, the envisioned goals of socio-economic development would remain elusive (Tondi, 2019). This study is rooted in the view of Empiricism in the transformative learning process. According to Kreber (2013) this view is construed as an 'authentic practice', the scholarship of teaching emerges as an activity that is guided by certain standards of excellence, virtues and values. As such, education should offer experiences that help students become prepared for the 21st century. Contrary to this view, Kreber posits that lack of authenticity in university teaching is mostly attributed to lecturers' inability to connect deeply with the subject matter and their role as educators. In line with Kreber's view on the transformative learning process, we emphasise the importance of producing science and mathematics teachers capable of using culturally familiar objects

in the teaching and learning of science and mathematics. The outcomes of this study might be of value to the Higher Education Institutions (HEIs) preparing pre-service science and mathematics teachers in the country and the Southern Africa Development Community (SADC) region, educational authorities who employ the student teachers and the communities where they live and work.

Literature Review

In recent years, there has been a growing and strong drive towards recognizing and affirming the critical role of Indigenous Knowledge System (IKS) in science and technology education (Magara, 2015; Ministry of Higher Education Technology and Innovation, 2021). The Revised Policy on National Science, Technology and Innovation (2021) encourages researchers to carry out IK research in order to improve the livelihoods of the citizens and its use in enhancing pupils' and learners' understanding of western science. IK knowledge is referred to as a unique knowledge generated by local communities while science refers to western knowledge based on established laws that came about as the application of scientific principles. Nonetheless, little cooperation has been forthcoming from education stakeholders in the country including teachers, teacher educators and curriculum developers in realising this noble idea. In the same vein, Owuor (2007) points out that in the case of Kenya, the lack of agreement among education stakeholders regarding which IK content to integrate in the school curriculum makes the integration difficult. Although Owuor focuses on school curriculum this deficiency has a ripple effect later on in the integration of IKS in the higher education curriculum. Mpofu et al. (2014) also emphasise the inclusion of IK in the education process of higher education in order to enhance community livelihood and development, despite the complexities, tensions and dilemmas noted in the design and implementation of IK integration. It is worth noting that those previously educated during the colonial era have not pursued authentic practices that would pave the way for the integration of IK in the higher education curriculum. They hold allegiance to the western education system and look with distain upon such efforts (Kreber, 2013). This approach disregards the Universal Declaration of Human Rights and the African Charter on the Rights and Welfare of the Child of 1948 that states that children need to be granted opportunities to study in an acceptable and adaptable education system that improves their understanding of who they are and they can be, rather than teach them values that degrade Africa and its culture. Central to this idea is that the education system need to support cultural initiatives by way of encouraging teachers to study local languages so that they can be qualified to teach students (Chavez, 2016). Furthermore, Chavez posits that a high quality of instruction in local languages may help society to change its attitude about inferiority complex that many possess and display. However, student teachers in Namibia are not taught African values in their local languages although it would have been more meaningful and consequently added more IK content to the Higher education curriculum.

Teachers as implementers of the curriculum play an important role in its actualisation in the classroom. The transfer of indigenous knowledge from everyday life to schoolwork is not always valued or encouraged, and indigenous ways of knowing may not be recognized by teachers (Semali & Mehta, 2012; Taylor & Cameron, 2016). It is therefore necessary that school teachers, especially science and mathematics teachers are introduced to IK content and ideas that will enable them teach their school subject content using IK ideas which are familiar to their learners and are found in their environment. Although Indigenous Knowledge (IK) is usually regarded as unscientific, because it often lacks "Western science rigour" we believe that it is important for student teachers to understand and use the locally available knowledge and scientific base in making the school content real to the learners. It is therefore important that IK, which is the local knowledge unique to a particular culture or society be integrated in the formal teacher preparation curriculum to enable them realise its importance and value and that it is possible to teach the school content using IK ideas and examples. Khupe (2014) notes that when knowledge of IK is understood, it could be appropriately applied in the classroom which would enhance learners' understanding of the content being learned. Khupe further argues that IK integration in curricula has been left to lecturers' discretion and in the absence of clear guidelines, the knowledge may lead to exclusion of those student teachers who may be interested in pursuing the concept later on in life. A number of researchers have focused on the students and pedagogy but there has been only a limited emphasis on the student teachers with respect to how well they are prepared to incorporate IKS in science classrooms should they become teachers (Michie, 2014). The integration of Indigenous

Knowledge into formal education curricula remains a concern at most institutions of higher learning (Mekoa, 2015; Mukumbu Chinsembu & Hamunyela, 2015). Mekoa (2015) opines that this exclusion portrays a negative image and inferiority complex amongst the African race. Mekao further, notes that African academics do not advance the development and integration of IK through their instructions in departments and Faculties. Researchers note that one of the factors militating against the integration of IK in the school curriculum has been the lack of trained indigenous educators (Jumba & Mwiti, 2022; Owuor, 2007). This is probably true in most African countries. Brown & Haihambo (2017) also noted a deficiency in the Namibian curriculum as it is not responsive to the diverse learning needs. Avenues to capture and document IK for future use and the merits of integrating it in the formal curricula of Institutions of Higher Education (IHEs) need to be revisited (Kaya & Seleti, 2013; Mukumbu Chinsembu & Hamunyela, 2015). As stated earlier, IKS offers an alternative worldview to the scientific paradigm, and is as valid as Western science (Maweu, 2011; Mushayikwa & Ogunniyi, 2011). We are of the view that inclusion of IK concepts in our secondary school curricula will improve learners' understanding and performance in science and mathematics subjects since learners will be learning these subjects using what they experience within their communities and are familiar with. Further, we are of the view that this is possible if the process of sensitising and familiarising teachers to the value and viability of IK as a vehicle for learning school subject content is part of their teacher preparation programme.

One of the activities of the National Commission on Research in Science and Technology (NCRST) in Namibia "is to facilitate the integration of IKS into the Education Curriculum". Accordingly, we are of the view that once a large number of student teachers are exposed to the IK knowledge, they are more likely to propagate it through their teaching after they graduate. However, appropriate mechanisms are required for mainstreaming IK values in the science and mathematics curriculum for purposes of enhancing and improving it, inclusive of societal applications and understanding of scientific phenomena. Kasanda & Kapenda (2015) and Mashoko et al. (2016) note a growing increase in the integration of IK in the science curricula to ensure that the knowledge is not lost for development in Africa but integrated in the curriculum at all levels. Thus far, meaningful changes towards making IK the basic premise that informs educational policy and practice has not taken place (Lilemba & Matemba, 2015). Thus, the post-colonial curriculum remains dominated by linguistics and ideologically Western across the whole education system. The National Policy on Arts and Culture does not provide any guidance on how institutions of learning can implement a culturally sensitive curriculum. Like elsewhere, the introduction and implementation of IK is left to the discretion of the educator (Mekoa, 2015). In addition, Naidoo & Vithal (2014) question how teachers interpret and implement such a curriculum in practice. Langenhoven (2014) appear to suggest the "how" by introducing teachers to the "argumentative - based course" in which teachers are exposed to IK content. According to Langerhoven the participants felt the course was helpful at tertiary level than at school level. This article presents exhaustive literature on lack of inclusion of IKS in higher education curriculum, and creates opportunities for inclusion in the teacher preparation programme. We assume that if student teachers are introduced to IK content during the course may help them use this knowledge during their teaching with full confidence in presenting culturally relevant curriculum.

Teacher education programmes require a paradigm shift away from the western conventional ‘best practices’ of teacher education and professional development to include indigenous knowledge (IK) (Le Grange, 2007; Mhakure & Mushaikwa, 2014). Mudaly (2018) stresses the need to create new curriculum initiatives by enforcing the characteristics of who teaches, what is taught and how it is taught. This initiative invokes the discussions between Western and indigenous worldviews (Mhakure & Mushaikwa, 2014). Mhakure & Mushayikwa note that little effort has been put into describing fully and understanding the concept of knowledge based on Africa’s history of ideas and intellectual development by the African scholars (Kaya & Seleti, 2013). This could be attributed to the less or no recognition and acceptance of differences in world views. Madlela (2022) stresses the adoption of teacher training programmes that take interest in different world views and culture in an attempt to minimize tribal and conflict. Adopting the appropriate integration approach requires lecturers’ understanding to manage eurocentric Western Science (WS) and the IK discourses related matters carefully for effective learning and teaching (Le Grange, 2007; Mhakure & Mushaikwa, 2014). However, there is a lack of a coherent system to consistently produce fully prepared teachers such that

the range of science and pedagogical content they learn in the teacher preparation undergraduate programme is aligned to the science content they are required to teach later (Lekhu, 2023). On the contrary, Abonyi & Achimugu (2014) stress that school science programs should be designed to ensure hybridization of concepts and processes across cultural boundaries. Upon graduation, student teachers take up jobs in rural communities mostly, where there are no resources available to demonstrate western science as expected. Exposing student teachers to IK during teacher preparation may be useful in this situation and in developing a vision and educational practice for African people in directing the course for IKS integration at the same time appreciating other knowledge system(s) as equals. Indeed, this will make learners appreciate the richness of the science and mathematics knowledge found in their local environment which they have taken for granted and never think of as science or mathematics.

A variety of ways of preparing pre-service science and mathematics teachers for school teaching exists in the SADC region. In some countries science teachers for primary school phase are trained at Teachers' Colleges of Education which are often affiliated to the universities in their countries. Universities in these countries are expected to ensure quality of programmes at these teachers' colleges. Zambia and Zimbabwe are two examples. A recent phenomenon in teacher preparation in the SADC region has seen the Universities being involved in the preparation of primary school phase teachers, for example in Namibia and Botswana. This is an attempt to ensure that primary school teachers are strong in their content areas. In a way this is an attempt to have specialized teachers at the primary school level instead of generalists who teach everything. Such a mode does away with universities overseeing the academic activities of the associated teachers' colleges.

Two main modes exist for the preparation of secondary school science and mathematics teachers in the region. The first method is one we will refer to as the "integrated model". This is the model the University of Namibia (UNAM) is using at the moment in preparing secondary school science and mathematics teachers. In this model the pre-service student teachers are registered in the Faculty of Education, take professional courses in the Faculty while the content subjects are taken from the specialised Faculties such as Science, Humanities and Economic and Management. At one point of their training these teachers are expected to do teaching practice which may range from three weeks (which is dedicated to school observations only) to a semester (during which time they are actively involved in the actual teaching of learners) during which period they are assessed by the university staff and host teachers in the school. The second model requires pre-service science and mathematics students to complete their initial undergraduate studies in their subject area of specialization first. The duration of the initial undergraduate programme might be three to four years after which the potential science and mathematics teachers take a further one-year Postgraduate Diploma in Education (PGDE) during which time they are required to take professional courses from the Faculty or School of Education including a few weeks of teaching practice in the schools. This enables them to teach in schools as professionally qualified teachers.

To date in Namibia science and mathematics are being taught as culture-free subjects. The Namibian Constitution stipulates that all persons in Namibia have the right to education free of discrimination of culture or race (Ministry of Education and Culture, 1993). Further, Namibia is also a signatory to many international frameworks including Education for All (EFA) which are all aimed at improving the quality of education in member states (Office of the President, 2004). These frameworks give countries the freedom to explore ways of achieving the target goals. Wagle et al. (2024) recommend arts-based educational research in order to provide a "powerful and compelling means for practitioners to interrogate and re-envision the cultural assumptions underpinning mathematics and science education" (p. 636). Consequently, Namibia as a country, has developed a long term strategy, Vision 2030, and committed itself to an integrated, flexible education and training system that prepares learners to contribute to economic, moral, cultural and social development of the citizens throughout their lives (Republic of Namibia, 2017a). The aim of Vision 2030 is to transform Namibia into a knowledge based society by 2030. Knowledge based societies require the provision of quality education. Despite over 29 years of effort to improve the quality of education and the education sector receiving on average 22% of the national budget annually, poor performance continues to characterise many public schools in Namibia (Republic of Namibia, 2017b). Notwithstanding, Namibia has inhabitants of diverse cultures and backgrounds. The debates on science education in Namibia have

shifted from 'why' indigenous knowledge (IK) and indigenous knowledge Systems (IKS) should be included in science curriculum to considerations of 'how' they could be integrated, and about the pros and cons of managing different worldviews—IK and Western science—and their meanings and place in the Namibian school curricula, especially in rural schools (Kasanda & Kapenda, 2015) and the marginalized (Brown & Haihambo, 2015). Few studies have interrogated the integration of IK into the school science curriculum in Namibia (Kasanda & Kapenda, 2015; Mukumbu Chinsembu & Hamunyela, 2015), demonstrating lack of literature in Namibia. Nevertheless, the notion of the relevance of IK is documented in Kaya & Seleti (2013). They note that school curriculum in Africa has not been relevant to the needs and concerns of African societies and more so making higher education in the continent too distant from community concerns and production of graduates who tend to be insensitive to the developmental challenges of their local communities. Thus, institutions of higher learning produce graduates with low self-esteem who do not identify with their cultural practices (Shizha, 2014). On the other hand, Kaya (2013) stresses that IKS enables graduates to appreciate the role of culture in education and to be sensitive to the developmental challenges of local communities. Further, Kaya states that IK integration has not been possible in a number of African institutions of higher learning due to inadequate IK qualified staff, reference materials and limited institutional management support as a result of lack of knowledge and awareness on the importance of IK in the modern world. In addition, researchers have noted a lack of a conceptual framework to provide a clear African perspective and understanding of the IKS concept and integration thereof into higher education (Higgs & Van Niekerk, 2002; Kaya, 2013). In the same vein, there has been a greater awareness in many non-western countries of the need to revive the science embedded within various indigenous knowledge systems, otherwise known as ethno-science, a term bereft of a concise definition (Ogunniyi, 2004). This will enhance success, cognitive development and academic achievements among students and consequently the transformation of higher education (Mkhize & Ndimande-Hlongwa, 2014).

Teacher preparation curriculum should be cultural relevant, considering the rich scope of Indigenous knowledge (McDonald & Dominguez, 2010). The integration of IK squarely depends on teachers' ability to equip their learners with the necessary intellectual skills and subsequently on the training received at the institutions of higher learning (Ogunniyi, 2004). In the same light, Wagle et al. (2024), developed a critical cultural perspective on the need for a culturally based programme that enables the Nepalese pre-service teachers to expand on their cultural capital. They employed arts based imagination teaching methodology to try to develop a culturally inclusive mathematics education. This method allowed the pre-service students to explore multiple mathematical knowledge systems embedded in the daily practices of rural and remote villages across Nepal, and developed contextualized pedagogical perspectives to serve the diverse interests and aspirations of Nepali school children. The methods included the following images: curriculum as holistic enactment which is inclusive of conventional and local mathematics knowledge systems and which promotes inter contextual adaptation of knowledge.

Secondly, within this holistic curriculum image they envisaged a contextualised curriculum comprising a mosaic of images such as curriculum as; personal reconceptualisation, as lived experience, as cultural reconstruction, and as critical and imaginative inquiry. This curriculum would promote learning as culturally situated meaning making, together with learning as critical reflective inquiry, learning as a two-way cultural border crossing, and learning as cultural negotiation. In doing so, they envisaged future teachers as culture workers who would appreciate local mathematical concepts as 'cultural knowledge Systems' for students to become culturally connected users of mathematics throughout their lives (Pant et al., 2023). In addition, Kimmerle et al. (2021) propose the use of argumentation in the teaching and learning of science during the teacher preparatory process. This approach provides student teachers with an opportunity to practice and develop analytical skills. Teachers are required to organize small groups; act as initiators of argumentative discussions; to provide writing frames to assist the write up process; facilitate role plays and allow group presentations. However, the coordination of strategies was found to be demanding and few accepted minimally due to a number of reasons such as classroom size and attitude and may not be sustainable but could be achievable (Kimmerle et al., 2021). Further, Sampson et al. (2013) raises a number of questions regarding the implementation of the "argumentative - based course" methodology and is of the view that the effort is commendable but, several factors should be addressed including the position of the

universities on IK integration in the teacher preparation programme. The universities where teachers are trained may prove to be stumbling blocks in promoting the inclusion of IK because they have vested interest in the western knowledge (Ogunniyi & Mushayikwa, 2015).

Moreover, Mpofu et al. (2014) stress the complexities, tension and dilemmas inherent in the design and the implementation process of the IKS integration. Nonetheless, we are of the view that the above sentiments should be considered when introducing IK in the school curriculum. Researchers observed Sitsha (2023) found teachers to be enthusiastic about IKS integration in the school curriculum but less optimistic about its success in schools (Sitsha, 2023; Taylor & Cameron, 2016). Buy-in by all education stakeholders is crucial to the successful integration of IK in the school curriculum. Ted View (2017) proposes that the teacher needs to be enabled to take on the role of cultural broker, a skill that is necessary too for student teachers to mediate or negotiate cultural borders. This makes science and mathematics learning relevant and not entirely abstract contents which have no use in the learners' lives, and is only learned to pass the examinations at the end of the academic year and then forgotten.

A wealth of knowledge exists among African communities demonstrate intellectualism and therefore the need for its integration to broaden and deepening the many possibilities of integrating different theoretical perspectives in the scholarship of training in higher education (Kaya & Seleti, 2013; Kreber, 2013). Further, Kaya and Seleti indicate that the integration of IKS into Higher education will: (i) provide students with the opportunity to learn appropriate community attitudes and values for sustainable livelihood. (ii) students will be able to learn through culture because AIK (African Indigenous Knowledge) is stored in various cultural forms, for example, folk stories, songs, folk drama, legends, proverbs, myths, etcetera; and (iii) involving community knowledge holders in research, teaching, and learning enables students to learn across generations hence making them appreciate and respect the knowledge of elders and other community members. In this context, higher education will be an agency for transferring culture from one generation to the next (Kaya & Seleti, 2013).

For this study, we assume that student teachers are both producers and consumers of knowledge in the education process. As stated earlier, student teachers invest in education by attending classes with the hope of being exposed to authentic practices that will enhance their future productive and earnings capacity. Thus, student teachers expect the education system to contribute to their human capital development, including knowledge and material gains (Krieg et al., 2022). In an effort to promote standards of excellence, Fakoyede & Otulaja (2020) propose the use of cultural artifacts or cultural realia as culturally related instructional models (CRIMs) to teach and learn abstract science concepts. This approach tends to bring science closer to the indigenous learners' consciousness, thereby enabling more familiarity with concrete or abstract science concepts. Consequently, student teachers will learn science effectively being active participants in the teaching and learning process. Thus, through this practice, students are encouraged to express and expand their cognitive constructs of what learning science from cultural perspectives looks and feels like. In addition, students will be afforded an opportunity to develop their capitals, with respect to cultural, social and symbolic capitals, and further enhance the development of cognitive capital leading to the emergence of more knowledgeable other(s) within indigenous science classrooms.

RESEARCH METHODS

We used an exploratory mixed method to collect student teachers' knowledge and perceptions regarding the inclusion of IK content in their teacher preparation programme. The combined use of quantitative and qualitative data collection methods was used to provide a better understanding of the research problem and triangulation purposes (Meister, 2018). This method provided us with a complete student teachers’ understanding of IK and its perceived importance in their teaching career. In addition to the survey of 64 student teachers (3rd and 4th year), we conducted a focus group discussion to understand the reasons behind the responses given to questions in the questionnaire. In pursuit of the authentic practice that is relevant to the IK integration in the science and mathematics curriculum, the students expressed their perceptions as follows:

RESULTS AND DISCUSSION

The pre-service science and mathematics teachers generally understood IKS as knowledge gained from local communities as compared to western science and should therefore be preserved for future generations. The sentiments are expressed in the quotes below:

> *Western science is the knowledge that relies on the establishment of laws through the application of science methods to the phenomena. It begins with an observation and is followed by a prediction or hypothesis that has to be tested … while the IK refers to the understanding, skills, and philosophies developed by societies with long histories of interaction with their natural phenomena.* (Student teacher 58, September 2021)

> *Western science is knowledge that involves experiment and technology while IK means African beliefs, morals and wisdom in different communities.Further, the study revealed that the majority of the student teachers (90.6%) believed that both western knowledge and indigenous knowledge should be included in the science and mathematics curriculum as evidenced by the quotations below.* (Student teacher 54, September 2021)

> *Indigenous ideas and knowledge must be respected and therefore be taught in Namibian schools…to equip future generations with knowledge of their culture and forefathers in order to maintain traditions and beliefs of the indigenous people. However, it is also important to keep abreast with the world by introducing western knowledge to indigenous people. This information can be mind-opening and therefore can broaden IK.* (Student teacher 9, September 2021)

> *Some schools have learners who are not from indigenous communities and it might disadvantage them to be introduced to IK*.(Student teacher 54, September 2021)

Only 34.4% of the student teachers expressed the view that IK content should be included in their teacher preparation programme while others had no idea. This view seems to contradict their later response as to whether IK should be part of the teacher preparation programme, with 87.5% expressing the desire to be introduced to IK. Those that saw relevance of IK in the Teacher Preparation Programme (TTP) stated the benefits of its integration thus:

> *It will educate the youth about their own cultures as well as provide the basis for local-level decision-making about many fundamental aspects of day-to-day life.* (Student teacher 58, September 2021)

The student teachers' understanding of IK is in line with that indicated by Kaya & Seleti (2013) and Owuor (2007) among others, that, generally the term refers to the promotion of African indigenous knowledge for sustainable livelihood and incorporates non-western beliefs, practices, customs, worldviews inclusive of informal education. This is in line with one of the strands of research emphasis by the National Commission on Research Science and Technology (NCRST) in the country, which is mandated among other tasks to "Enhance, recognise, develop, and promote the value and the role of Indigenous Knowledge and Technology for development". This emphasis might help "... entrench indigenous knowledge in the 'global village' and into the 'mainstream' systems in order to debunk the belief that the modern western oriented knowledge system is the only viable one (Maweu, 2011).

Standards of excellence

Student teachers felt that the IK content received during their TPP is not enough (42.2%) and it did not make them confident in using it in their specific areas of specialization. Thus, they felt less equipped in terms of IK knowledge and skill transfer.

> *Some lecturers mostly focus only on examination content and forget to relate examination content with real life situation.* (Student teacher 64, September 2021)

I want to be better informed and equipped on how to correctly transfer knowledge to learners. However, some student teachers (59.8%) expressed the need to be introduced to IK content during their preparation. (Student teacher 9, September 2021)

The trainees stated that:

Teaching IK should be made compulsory in the school curriculum. (Student teacher 63, September 2021)

The Ministry of Education has the biggest role to play in fully implementing laws that support indigenous knowledge. (Student teacher 46, September 2021)

In addition, almost half (48.4%) of the student teachers believed that there were certain topics that could be taught best using IK. These topics included among others: Preparation of seed beds, Compost and Agriculture, Nuclear Physics, Force, Food production, sustainable agriculture, traditional medicine, HIV and AIDS. On the question on problems the student teachers saw as hindering the infusion of IK in the Higher Education (HE) curriculum, they stated the following:

People are ashamed of the IK because they value Western Knowledge more than IK and therefore lecturers do not have enough knowledge about IK and those with the knowledge are not proud to disseminate it. (Student teacher 63, September 2021)

Lack of sufficient trained people to pass on the knowledge and therefore the curriculum does not fully supplement the use of IK. (Student teacher 46, September 2021)

Institutionalised racism and discouragement of celebrating language and identity. (Student teacher 13, September 2021)

However, the student teachers identified hindrances that needed to be addressed in order to ensure the integration of IK into HE programmes:

Support indigenous communities by supporting their rights to education and beyond. (Student teacher 58, September 2021)

The Ministry of Education needs to train and ensure that student teachers are given in-service training on IK. (Student teacher 36, September 2021)

Efforts to integrate IKS in the school curriculum were sought via various teaching strategies such as iSPACE (Semali et al., 2015), culturally related instructional models (CRIM) (Fakoyede & Otulaja, 2020), NOB and A-B (Ogunniyi & Hewson, 2008). These strategies have potential to contribute unique opportunities to science, theory and indigenous innovations, in an effort to spur new instructional practices, standard, curriculum materials professional and community engagements. These new perspectives could be adopted in teacher training programmes.

Virtues and values of IK

A few student teachers who saw value in IK emphasised that learning and understanding of scientific concepts should co-exist with western science so as to enhance the learners' grasp of the science and mathematics concepts in Namibian schools. After all, teaching the Western curriculum has not been effective given the higher failure rate in mathematics and science at school (Kanandjebo, 2016; Ugulu, 2019). Magara (2015) stresses that universities need to ensure that students are taught IK values including nurturing critical thinking skills and widening creative expression. These skills could be passed on to learners to improve teaching and learning outcomes. Thus, inculcating IK knowledge in teacher education is a step in the right direction with respect to recognizing diversity in ways of knowing and recognizing the value of the local people that would be found in communities (Khupe, 2014) where

the student teachers would teach upon graduation. Nonetheless, we need to be mindful of the questions posed by Sampson et al. (2013) for the successful integration of IK in the school science and mathematics curriculum. The student teachers were also of the view that their teacher preparation programme did not prepare them adequately to use IK in teaching their subjects upon graduation. This is probably due to the fact that little IK content is included in their curriculum, and often it was at the lecturer's discretion to include it in his/her teaching since it is not included in the approved curriculum.

As such they are ill-prepared to teach the mathematics and/or science content integrating IK content. The lack of inclusion of content in their preparation would make the integration of IKS in the school curriculum as suggested by the NCRST almost impossible. Further, this finding supports that by Kaya (2013) and Owuor (2007) that institutions of higher learning in Africa lack qualified lecturers who would teach IK and in most cases it is left at the discretion of the lecturer to teach it any how without clear guidance. This has dire implications for the future of IK in Namibia culturally, politically, economically and socially. If IK is not promoted the issue of inferiority complex will perpertuate among the black Namibians as observed in South Africa (Mekoa, 2015). IK must be deliberately included in the teacher preparation programmes to enable the future teachers to realise its importance and be prepared to use it in their teaching. In addition, inclusion of IK would help to demystify the science and technology amongst student teachers and restore their dignity (Higgs & Van Niekerk, 2002; Maweu, 2011). Kaya & Seleti (2013) argue that African elders and other knowledge holders have demonstrated intellectualism that warrants inclusion in the curriculum, including cultural teaching approaches and gaining community knowledge through research. This knowledge could be passed on from generation to generation making the student teachers appreciate and respect the knowledge of elders and other community members. Indeed, one can only pass on what they know to others. If the future teachers are not exposed to IK content and ways of teaching or integrating it in their lessons during their initial teacher preparation courses, they will not be able to include it in their teaching and in the long run, the country will not attain the socio-economic and community development goals.

CONCLUSION

Currently, IK is not integrated in the teacher training programme at the University of Namibia. We maintain that IK be taken into account in teacher training progammes to advance the indigenised African innovations and knowledge systems for the benefit of the majority of Namibians. Teacher preparation programmes should not only emphasise the western knowledge and pay lip-service to IK, concrete steps with regard to promotion of, teaching strategies and attitudes and values towards integration of IK must be put in place to acknowledge its importance. Teacher training programmes should present opportunities to contribute to the development of Africa's unique science, theory, and indigenous innovations and in turn the development of new instructional practices, standards, curriculum materials, professional and community development, and dialogue among nations.

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