Exploring Possibilities for Including Indigenous Knowledge into the Biology Teacher Education Curriculum: Leveraging Insights from Karanga Knowledge Holders

Kutenda Trinos
ORCID iD: https://orcid.org/0000-0001-9226-5863

Ronicka Mudaly
ORCID iD: https://orcid.org/0000-0002-7347-2098

Abstract

The dearth of African knowledge and African methods of knowing in formal education perpetuates the colonial agenda that Africa and her people have little to contribute to the global knowledge repository. We seek to disrupt the ontological exiling of the colonised from education, in particular, pre-service teacher education, by shifting our gaze towards the affordances of African Indigenous Knowledge (AIK) in the present context of the COVID-19 pandemic. We depart from the epistemological centre, which is dominated by Euro-Western knowledge traditions, and explore marginalised epistemic sites, by tapping into knowledge/s of African traditional healers. We generated data through interviews using Zoom with five purposively selected indigenous knowledge holders from the Karanga community in Zimbabwe, to obtain their views about the causes and management of infectious diseases, including COVID-19. We found that from an African perspective, the outbreak of COVID-19 is attributed to spiritual explanations where illness is a punishment from the ancestors for the wrongs done by the living. *Dumwa/mutimwi* (a string from a special tree) tied to the neck, wrist, or waist, is used as a preventive measure against diseases. Quarantining and isolation are a common practice used by the African communities to prevent the spread of viral diseases. Consumption of traditional foods and medicines are encouraged to manage

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effects of viral infections. Parts of plants such as *Zumbani* and *Mufandichimuka* are used to treat symptoms caused by influenza viruses. These and other insights from Karanga indigenous knowledge holders will be embedded in the teacher education biology curriculum. By re-centering knowledges from the Global South, the peripherality of AIK in teacher education will be challenged.

Keywords: African indigenous knowledge, teacher education curriculum, decolonisation, ethno-medicinal plants, infectious diseases.

1 Introduction and Background

Disease management in Africa is informed by biomedical and indigenous knowledge perspectives which are, at times, dissonant. The biomedical perspective is developed primarily within the Euro-Western scientific health care system while the Indigenous Knowledge (IK) perspective is rooted in the traditions and practices of the indigenous people. Irrespective of the subjugation of the African Indigenous Knowledge (AIK) health care system as a result of colonisation, the health practices of local people in Africa are commonly used in disease control (Mokgobi 2015; Mandizadza & Chavunuka 2013).

Health care practices to which many Africans ascribe are often marginalised in formal education. Within academic circles there is international critique of the absence of local African knowledge practices in the curriculum (Ezeanya-Esiobu 2019; Kaya 2013). Wyk and Higgs (2012) contend that there is under-representation of indigenous knowledge in the curriculum in general. Hauser, Hewlett and Matthews (2009) emphasise that the under-representation of IK in science programmes renders science education programmes irrelevant to local communities. African countries are therefore challenged to resituate their university programmes by moving from the prevailing Eurocentric model which hushed, degraded, and disengaged IK education. Such re-orientation would contribute significantly to the conservation of the cultural legacy (Arenas, Reyes & Wyman 2012). Kaya (2013) posits that HE institutions are facing challenges in trying to decolonise their curriculum. However, efforts have been made at the University of Northwest and at the University of KwaZulu-Natal to lead initiatives towards including IKS into research, teaching, and learning since 2001. Okpokwasili

(2019) acknowledges the increasing visibility of IK in the Nigerian university curriculum. This includes but is not limited to using indigenous resources and inviting community elders to the university.

A curriculum which incorporates useful IK is crucial in the modern world, because there is the growing need for indigenous individuals to be allowed the opportunity to transmit and develop from their own insight and heritage (Govender & Mutendera 2020; Hauser, Hewlett & Matthews 2009; Mudaly 2018). This process involves incorporating an indigenous voice through accepting contributions of the indigenous people in research and curriculum development.

In this paper we examine possible approaches for the incorporation of Karanga indigenous knowledge into the teacher education biology curriculum. The pre-service teacher education program was offered in Mid-South State University, Zimbabwe. The biology module was the focus because we teach biology at our respective institutions and ways of knowing in this subject was of interest to us. A brief review of infectious diseases in Africa, and indigenous knowledge practices related to infectious diseases, is necessary to illuminate the continental context.

1.1 Infectious Diseases in Africa

Africa is regarded as a hub for many infectious diseases (Mendelson 2014). Infectious diseases are costly in Africa because they result in starvation, illness, and death, and impair economic development (Brownlie 2012). Common infectious diseases and pathogens that affect Africans include, but are not limited to, HIV/AIDS, malaria, tuberculosis, schistosomiasis, Guinea worm disease, river blindness, polio, measles, cholera, monkey pox, yellow fever, Rikkettsia felis, Zika virus, Ebola, acute respiratory infections, and Yersia pestis (Fenollar & Mediannikov 2018). This list was expanded in 2020 to include the novel Coronavirus (National Institute for Occupational Safety and Health [NIOSH] 2020).

Climatic, political, social, and economic factors are identified as key drivers of infectious diseases in Africa. The climatic conditions are conducive to habitation of vectors such as mosquitoes, tsetse fly, blackjack, bats, and many more (Brownlie 2012). Most infectious diseases have been under control but there is a trend of re-emerging and emerging new infectious diseases and Africa was deemed to be unprepared to handle emerging infections (Jalloh *et*

al. 2017). Therefore, in this paper we contend that there is need for Africa to rise to the challenges and develop home grown approaches to enable early detection, prevention, and healing of epidemics, guided by the under-utilised repository of available IK.

1.2 Indigenous Knowledge of Infectious Diseases

The analysis of disease management within the African context indicates that the spiritual world which is believed to protect from and inform of an outbreak, as well as provide healing from it, is important (Maunganidze 2016; Oyieke 2016). Oziama and Chinwe (2017) contend that divination, spiritualism, and herbalism are key to disease management. Herbalism is the study and use of plants in disease management, and is popular among 80% of the world population who use traditional medicines (Debprasad 2019). For example Adnan, Ali, Sheikh and Amber (2019) studied plants in the Himalayas that are used to treat pneumonia and tuberculosis. Maroyi (2011) in his studies in South-central Zimbabwe describes several plants that are used for managing different infections. A significant breakthrough to show the potential of medicinal plants is evident in the works of van Wyk, van Oudsthoorm and Gericke (2009) who produced a catalogue of ethno-medicinal plants in South Africa. In Zimbabwe, Maroyi (2011) and Mpofu (2016) compiled a catalogue of ethno-medicinal plants used in the South-central and Mashonaland central parts respectively.

Walwyn (2018) avers that traditional medicines and its practitioners are playing a crucial role in the fight against HIV/AIDS. Msila (2017) argued that there is need to represent indigenous health practices in Higher Education (HE) to reduce ethnic inequalities. Msila (2017) observed that there is the re-emergence of use of ethno-medicines in society today and viewed this as an opportunity to reverse the effects of epistemicide of knowledges of particular ethnic groups. However, the use of IK in the provision of primary health has survived time and challenges (Mpofu 2016), hence it should be included in the provision of primary health care. Horrill, McMillan and Thompson (2018) noted that the IK perspective to primary health care provision lacks scientific reduction, verification, control, prediction and objectivity in its practices, and this has posed a challenge to including IK in health care. Hence, the supremacy of the Euro-Western biomedical perspectives towards the provision of primary health care, despite the fact that a large percentage of the world's population

depend on IK for maintaining good health (Debprasad 2018). Against this background the World Health Organisation (WHO), in 1978, called for inclusion of local communities and their practices in providing primary health care. Therefore, we contend that universities should strive to include IK in teacher training courses so that teachers will be prepared to serve the community from informed positions.

1.3 Understanding Decolonisation

This paper is rooted within the decolonisation framework. One way of addressing decolonisation in education is by developing an inclusive curriculum (le Grange 2016). Decolonisation is a 'restorative epistemic agenda and process that simultaneously addresses ontological and epistemological issues haunting Africa' (Ndlovu-Gatsheni 2015:2). This means undoing the injustices that have been violently imposed in the Himalayas on Africans. In higher education this means confronting practices that have influenced education in the past, and that are still present today. Mahabeer (2019) and Matiwana (2017) define decolonisation as a deconstruction approach that aims to undo cultural violence imposed by colonialism. Matiwana (2017:18) explains decolonisation as 'epistemic de-thinking from European constructed curricula'. Thus, the process of decolonisation aims to have an epistemic shift and identifies IK as a knowledge system that can respectfully be considered in curriculum development. Sathorar and Geduld (2018) argue that such a shift signals an approach towards a counterhegemonic space. Ngugi (cited in Fomunyam 2017) views decolonisation as a process of rejecting the centrality of western culture in Africa and rethinking and recentering their culture and intellectuality (Fomunyam 2017).

Ritskes (2012:1) describes decolonisation as the 'foundation for resurrection of IK epistemological ways of living'. This resonates well with le Grange's (2018) postulation that knowledge must be a product of cultural activities with relevance to the society from which it was generated. Ndlovu-Gatsheni (2015) further emphasises that decolonisation is a process of challenging globalisation and universalism which contribute to the endless domination of the Euro-Western knowledge systems over other knowledge systems. Therefore, there is an urgent need for epistemic freedom over political freedom and to re-humanise education (Torres 2007). In this paper we view the revival of IK as one way towards decolonising the curriculum, to promote

relevance and to develop an inclusive curriculum in a teacher education module.

2 Pre-service Teacher Training and IKS

Mandikonza (2019) explored how indigenous knowledge practices and skills could be integrated into a pre-service science teacher programme in South Africa. Learning experiences which resonated with learners' communal and personal lives were used to make meaning of science concepts. Physical (for example, woven baskets) and non-physical (for example, language) cultural artefacts were used to teach science concepts. Vignettes from an exploration of IK practices by the researcher, were shared with pre-service teachers to make them more familiar with habitual IK practices in the community. A community member who was a repository of IK demonstrated the process of traditional beer making to pre-service teachers. who were then required to work collaboratively to develop lesson plans to reflect how IK practices could be harnessed to teach science. They taught these lessons during micro-teaching sessions and engaged in group reflections on their teaching. The construction of the knowledge of science by advancing from context to concept was advocated. The advantage of this approach is that pre-service teacher learning occurred through collaborative efforts, and subsequently, they appropriated their learning at an individual level. The importance of multiple methods to enable pre-service teacher learning is significant because pre-service teachers' tacit knowledge differs from one individual to another.

3 Theoretical Constructs

The principal focus on decolonisation is based on the acknowledgement that the university curriculum is foreign to Africans (Ng'asike 2019). Higher Education Institutions (HEIs) are viewed as centres that promote Euro-centric ideals and at the same time exclude knowledge of the colonised (le Grange 2016). This calls for the decolonisation of the university curriculum. Therefore, we work towards an inclusive curriculum as a way of resisting 'coloniality of knowledge, of power and of being' (Walton 2018:31). We advance the valuing of subjugated epistemic perspectives and disrupt the notion that knowledge which is embedded in Euro-Western frameworks is universal. We resist the historical marginalisation of colonised people by giving them a voice and

making them visible, by valuing and including their knowledge in science teacher education. However, we are aware of contestation around the conceptualisation of an inclusive curriculum. Hess (2015) cautions against incorporating indigenous practices as peripheral to the Euro-Western centre, because this renders the curriculum as a vehicle for racialisation and ethnicisation.

A decolonised curriculum as propounded by le Grange (2016:9) is rooted in the '4Rs: rational accountability, respectful representation, reciprocal appropriation, and rights and regulation'. Rational accountability in this case refers to an inclusive and interconnected curriculum. Thus a teacher education curriculum that produces a teacher who is well versed in the different knowledges is a useful endeavour. It is important for teachers to understand the norms, beliefs, values and cultures of the community in which they are working. Respectful representation refers to cognisance of IK as a vital cog towards decolonisation of the curriculum. This entails accepting selected indigenous knowledge for inclusion in the biology curriculum for teachers. Reciprocal appropriation refers to acceptance of different ways of knowing and creating democratic spaces for co-existence in order to have a just curriculum. Rights and regulation entails acknowledging indigenous people as owners of the knowledge being used in the curriculum.

Chilisa (cited in le Grange 2016:5) described five phases used to decolonise the curriculum:

> 1. Rediscovery and recovery are concerned about the colonised re-defining of their history, culture, language, and identity. Rediscovery and recovery are rooted in indigenous people retrieving their marginalised cultural heritage and identity, with the critical aim of including it into the curriculum.
>
> 2. Mourning refers to (re)imagining the unfortunate perpetuation of colonial culture that defined (and continues to define) the university curriculum in colonised communities.
>
> 3. Dreaming is an aspiration by the colonised to have their knowledge practices included in the university curriculum.
>
> 4. Commitment is an awakening conversation involving all stakeholders to realise the existence of marginalised knowledge systems with the po-

tential to solve contemporary problems. Such knowledges need to be integrated into the university curriculum.

5. Action involves identifying appropriate ways of including IK into teacher education, therefore we seek co-existence of different knowledge systems without excluding Euro-Western knowledge and practices - a decentring approach to decolonisation.

Curriculum decolonisation can also be approached from the social reconstruction approach. Zeleza (cited in Heleta 2016) advocates for a deconstructionist approach towards decolonisation. The argument in a deconstructionist approach is to dismantle the domination of Euro-Western ideologies in the curriculum. By deconstructing the curriculum, the muting of IKS in the curriculum becomes visible, and spaces for dreaming and commitment (Chilisa in le Grange 2016) become illuminated. It allows for respectful representation of IK in the curriculum, based on an understanding of norms, beliefs, and values of the communities. Relational accountability, where the IK which is included in the curriculum can be applied to solve problems, such as responding to health problems of the community, becomes feasible. 'Universities must completely re-think, reframe and reconstruct the curriculum and bring South Africa, Southern Africa and Africa to the centre of teaching, learning and research' (Heleta 2016:9).

The incorporation of IK into a module is significant because it positions IK as legitimate, valuable knowledge which should be a part of the higher education curriculum. The key question is: 'How can insights of Karanga IK holders to manage infectious diseases be included in a teacher education biology module?'

4 Methodology

This study was underpinned by the critical paradigm, because it addressed inequality of knowledge representation, rooted in discrimination and oppression. We disrupted the epistemic power hierarchy by envisaging a transformation towards an emancipatory curriculum, which is counterhegemonic (Ngulube, Dube & Mhlongo 2015). This paradigm was appropriate because it promotes active interaction between the researcher and the participants, based on dialogic methodologies and respect for cultural

norms (Mertens 2015).

A social reconstructionist approach was adopted because the main focus was to decolonise the biology module by creating possibilities for including IK into it. Social reconstruction is linked to the critical theoretical understanding of educators as potential agents of socio-cultural reform (Kivunja & Kuyini 2017). It is anticipated that this will result in a culturally sensitive teacher education program, and greater inclusivity in knowledge representation.

Qualitative methodology underpinned this study as it was suitable because it involved direct research into the network of practices to acquire the participants' perspectives, convictions, and accounts, prompting an increasingly profound investigation and comprehension of the familiarities (Chilisa 2011; Mertens, Chilisa & Cram 2013). This study was guided by participatory methods, which were appropriate because this study is emancipatory in nature. Participatory methods allow people from extremely disadvantaged communities to identify and reflect on issues that impact negatively on their lives (links to Chilisa's 2012) theoretical construct of mourning), and establish prospects for a positive change (links to Chilisa's 2012, theoretical construct of action). Using participatory methods, we interrupt the valourisation of Euro-Western knowledge holders over indigenous knowledge holders (Mudaly 2018). We also disrupt the marginalisation of IK in HE, by listening to voices and privileging knowledge of IK holders in the curriculum.

4.1 Ethics, Recruitment, and Sampling

We sought gatekeeper permission from the higher education institution and obtained ethical clearance (Protocol HSSREC/00001877/2020) after obtaining permission from the Chief of Midlands Province in Zimbabwe, who was the head of a group of Karanga communities. The university where the module being examined in this study was offered, was also in the same province. Inserting indigenous knowledge into the university curriculum from knowledge holders who practice in the same province would link the university and broader community and enhance the relevance of the module. Our decision to work with the Karanga IK holders was also because they are well known throughout the country for their successful treatments. We requested the Chief to assist us in recruiting IK holders because the Chief showed great enthusiasm

about our project. In using purposive sampling, we emphasised to the Chief that participation would be voluntary and that we planned to include IK holders who had a reliable record of success in diagnosing and treating infectious diseases, and vast experience in indigenous practices. Eight IK holders were invited by the Chief to meet us. However, only five agreed to participate. The other three were not keen on having their knowledge integrated into a formal curriculum. We ensured that participation was voluntary, and that each participant was an autonomous individual. Written informed consent documents were signed by the participants, who were briefed on, among other things, their right to participate autonomously and voluntarily, and the right to withdraw from the study without negative consequences.

This study was carried out in two phases. The first phase was in the Makuwerere area under Chief Chingoma, Mberengwa District, Midlands Province, to generate data from IK holders. The second was at Mid-South State University and involved document analysis of the module. To access the biology module, we applied to the Mid-South State University registrar highlighting the research topic, purpose of the study, and how the university fits into the study. The permission was granted. Our positionality is that we are researchers who are external to that university.

4.2 Data Generation

Semi-structured interviews and document analysis were used to generate data. Semi-structured interviews were conducted through Zoom meetings. These interviews allow for several planned inquiries, and also affords the interviewer the opportunity to alter the sequencing of inquiries and on occasion clarify them by changing the wording or expanding for further elaboration (Annum 2015). This gives flexibility, and advances understanding of the case. This method was appropriate because it afforded a thorough exploration of the undocumented IK holders' management of infectious diseases. Each participant took part in a single interview that lasted between 20 to 30 minutes. All interviews were video recorded to capture the actual words of the participants. Participants were encouraged to use the language which they were familiar with and all interviews were conducted in Chishona. As such we automatically became researcher transcribers during this study. Whatsapp was used to collect pictures of plants which the IK holders used to treat infectious diseases.

We also carried out a detailed document analysis to establish the existing content and pedagogy related to infectious diseases within the biology module for pre-service teachers. Wach (2018) characterises Qualitative Document Analysis (QDA) as a procedure of breaking down composed records methodically to get a profound comprehension of the contents. Owen (2014) affirms that document analysis is utilised to inspire meaning, increase understanding, and create exact information. Document analysis was useful, therefore, to illuminate possibilities for including IK content and pedagogy.

5 Findings and Discussion

We used thematic analysis to understand our data. This process according to Rosalia (2019) involves the organised breaking down of data from excerpts, allocating codes that build up into a theme. In this case we identified a theme as a description that emerges multiple times in data sources. We manually annotated and highlighted the data and key ideas were transcribed into a memo. From the memo we developed codes that we combined to generate main themes.

Theme1: Outbreak of Infectious Diseases: A World View of the Karanga IK Holders

Indigenous knowledge is embedded in cultural practices that characterise day to day operations of indigenous communities. The Karanga indigenous belief is that if one's ancestors are unhappy they withdraw their protection '*midzumu yadambura mbereko'* and one can then experience mishaps such as illness. As such the ancestors are believed to be spiritual caregivers, and anything done by the living is linked to the spirit. Therefore, the living are obligated to give attention to the ancestral spirits and in turn the ancestral spirits will provide protection. In presenting results we use the codes KP01 for Karanga Participant 1, KP02 for Karanga Participant 2 and so on.

The following excerpts reveal the Karanga knowledge holders' beliefs in spiritual protection.

KP01: *My child, our protection comes from the ancestors. We are now*

> *neglecting our ancestors as such the ancestors have withdrawn their protection.*

The notion of ancestral protection is a common belief amongst the Karanga knowledge holders. The proposition by KP01 is supported by KP02 and KP04:

> KP02: *The young generation is doing things that angers the ancestors, and most diseases affect the young.*
> KP04: *If the ancestors withdraw their protection you are bound to experience many mishaps, the idea of mbereko* (a baby carrier) *being cut loose mirrors the dangers a baby may face.*

It is crucial to note that the IK holders engage in mourning (Chilisa 2012) about the erosion of their knowledge. For example KP01 asserts: *'…we are neglecting our ancestors…',* and KP02 says: *'……the young are doing bad things…..'*. The notion is that neglect of traditional beliefs ultimately leads to mishaps. The Karanga IK holders also believe that witchcraft can cause illness. They believe that the spirit of witching is done to inflict harm/pain to the enemy and could be borne out of jealousy. Ancestors are believed to provide protection from being bewitched. However, *mudzimu* (ancestral spirit), can allow one to be bewitched as a form of punishment for not appeasing the dead. This is supported by the following excerpts:

> KP02: *One may fall ill due to witchcraft, mainly due to jealousy of one's success in the community.*
> KP05: *Witchcraft exists, but the Witch asks for permission from your ancestors*

Karanga IK holders also ascribe to the notion that infectious diseases can be spread through air and water. Their belief is that ancestral spirits can live in water, trees, and in air. Therefore, anyone who falls sick is being punished by the spirits in the air and/or in water. The general understanding of the Karanga IK holders on the advent of COVID-19 is that it is spread through air and can be linked spiritually. This is supported by the following assertions:

> KP05: *[Referring to Corona neChiShona chiri mugroup rechipehwe (kukukosora), zvikonzero chando neutachiona,chinopararira*

> *muvanhu vakaungana nemumhepo] COVID-19 falls in the same group as whooping cough, influenza(chikosoro) which are spread through air or when one experience cold conditions.*

They believe that all those who succumb to the infection are being punished by the *mudzimu*. Likewise, all those who recover are viewed as having repented to the ancestral call and restored the spiritual protection.

> KP03: *If you fall ill and seek help from your ancestors you will recover.*

This was echoed in the following excerpt:

> KP03: *To save life a traditional ceremony with traditional beer is organised and elders in the family will request the ancestors to forgive you.*

While biomedical researchers are seeking the main causes of the novel Coronavirus outbreak, the Karanga IK holders are seeking the spiritual reunion. The perception of the spirits not being happy is a key concern for the Karanga IK holders. They believe that neglect of ancestors or other negative acts committed by the living have resulted in infection with COVID-19 as a spiritual punishment. Their call is for all people to link with their ancestors, through traditional ceremonies in which spirit mediums will be asked to interlink with the ancestors, and this would guarantee protection from such infections. This is supported by the following excerpt:

> KP05: *In the past whenever there was a problem. Spirit mediums were consulted, and in most cases would ask the Chief and his people to organise a traditional ceremony, that will seek to restore normalcy in the community.*

Theme 2: Prevention and Treatment of Infectious Diseases: The Karanga Approaches

For the Karanga people, protecting members of the community from any harm and is important. A number of practices including herbal treatments towards

preventing and treating infectious diseases were highlighted. This support the principle that every society has its own practices which are best understood by its people.

All five IK holders identified an indigenous herb called *Chifumuro* (*Dicoma anomala*), that is used to prevent the spread of diseases from birth until death. They had a strong conviction that everyone can use this herb in order to be immune from any infection. This according to the knowledge holders has been in use for time immemorial, hence their confidence and trust in the herb.

> KP02: *We use this plant to prevent diseases in both the young and the old.*

A string made from the woody stem or a root tied to fibre string, is tied around one's neck, wrist or waist. This proactive measure is believed to prevent the person from getting infected or to diminish the effects of an infection. The isolation of the sick person is used by the Karanga IK holders to prevent spreading of infectious diseases. For example, all the ill people with infections that cause serious coughing are confined to separate huts, where they will be visited by the indigenous knowledge holder who would administer treatment and provide food. This is the isolation approach which resonates with the current approaches prescribed by WHO to reduce the spread of COVID-19. Traditionally, patients who were infectious were moved to mountains or faraway places to prevent contact with other people. These people would only reunite with their families or the community when they were fully healed. This approach is equivalent to the present-day Centres for Infectious Diseases, where quarantining is being done until a person recovers. Isolation and social distancing, currently enforced globally to stem the COVID-19 pandemic, form a key part of indigenous approaches to infectious diseases, and is useful to include in a formal curriculum. This is supported by the following assertion:

> KP01: *A sick person is admitted in his or her own hut until recovery. Only the IK holder or traditional healer is allowed to visit.*

IK holders also highlighted the importance of treatment huts (clinics) which are either outside the homestead of the IK healers or are located away from other huts, in the direction towards which wind frequently blows. This reflects

the idea that the Karanga IK holders are aware of the existence of airborne diseases which should be prevented. Also, young children were not allowed to visit the treatment huts to protect them from getting infected. Indigenous knowledge holders recognised that younger people have weaker immune systems.

> KP04: *The treatment hut is located away and in the direction towards which wind blows with respect to other huts to prevent airborne infections.*

The IK holders shared the modern approaches to diseases management and prevention. This signals a merged approach to disease management in the time of COVID-19. The knowledge holders highlighted the use of social distancing, hygienic health practices that include the use of soap for thorough hand washing, and educating other members of the community about the need to prevent the spread of infections. Also, the need to avoid sharing utensils and clothes was emphasised, although this is contrary to the African philosophy that what one has belongs to everyone. This reflects the adaptability of IK to suit different situations.

> KP03: *We encourage good health practices amongst community members. People should use soap to wash their hands*

Hand hygiene is enabled because a hand washing point is located outside each homestead (Figure 1).

Generally, the IK holders were convinced about the potency and efficacy of their medicinal practices. They boasted of having no recorded infections of COVID-19 in their community at the time when data was collected. The knowledge holders highlighted that sharing of utensils, clothing, blankets and even bedding is not allowed amongst community members.

> KP05: *We discourage people from using the same blankets and bed when they are sleeping. Each person must sleep under his/her blankets to prevent passing on of infections (kupomerana). Again we encourage our kids not to use same the cup when drinking water …and to use mukombe (a traditional cup with a long handle) to get water from the bucket. This prevents contamination and spreading of diseases*

Figure 1. Hand washing point at the gate of one IK holder in Makuwerere area

These practices, among others, are used to prevent the spread of infectious diseases and are being applied in the time of COVID-19. Generally, we observed that there are similarities in socio-behavioural interventions (sanitation, not sharing utensils, isolation, social distancing) in both the Euro-Western and Indigenous ways of managing infections. A resuscitation of indigenous practices, which we term 'people's knowledge' is what we advocate for in this study.

The sharing of knowledge for the benefit of the community was also revealed.

> KP03: *As a matter of fact we are only now hearing about the infection* (referring to COVID-19*). Our kids do not go to clinics regularly as we don't have money for consultation and* medication*. However, we thank our ancestors for the wisdom in plant healing. When we heard about this outbreak every family had to roll up the treatment herbs and we administered different herbs to our kids to boost their body defense so that they would not be affected by the infection and any other related diseases. We often share information on herbs and plant healing when a member of the community falls sick. In the current situation when the Chief called us for a public meeting we were commanded to sit a distance away from each other as news of the new infection was being shared. The Chief opened the platform for us to share the relevant information regarding how respiratory infections were managed. We shared a much information regarding herbal treatment and as of now I am convinced even those who were not believing in herbal treatment used these herbs.*

The public meeting served as a learning zone for the community. It is encouraging to note that the approach used by the Chief proved that IK is a community property which should be shared freely. This is unlike the Euro-Western knowledge dissemination platforms which are driven by profit and popularity. Karanga IK holders have a rich collection of ethno-medicinal plants which they use to treat infectious diseases. They believe that COVID-19 can be managed using different plants which are also used to treat other strains of influenza.

> KP01: *We use medicinal plants such as Mufandichimuka, Zumbani, Mugwavha Muruguru, Mubvumira, and Mugamutiri. In most cases we boil the part of the plant to extract the medicines. The medicine is ingested while still hot. Roots, leaves, and the bark are the most commonly used parts*

In the following section a comprehensive description of how each herb or tree is used, is presented.

All the participants identified *Mufandichimuka* (*Myrothamnus flabellifolius)* (Figure 2) which is used to treat cough, colds, and chest pains. They informed

us that the herb grows on rocky areas and when it is hot they dry out but once it rains they turn green, hence the name *Mufandichimuka* (can resurrect from the dead).

Figure 2. *Mufandichimuka (Myrothamnus flabellifolius):* (Source KP01, KP02, KP03)

On how it is used KP03 had this to say:

> *We take the leaves with twigs and boil in water. The patient is then asked to drink this while the extract is still hot. We use this to treat chest pains, coughs, and colds. We encourage our patients to take the extract 3 times a day until they are healed… in 2-3 days…*

Zumbani (*Lippia javanica)* is another plant that was identified by the participants as being useful in treating cough, colds, and flu.

Figure 2. *Zumbani (Lippia javanica):* (Source KP05)

This herb is administered through drinking the hot extract of the leaves, rubbing the leaves, and inhaling the smell of dry leaves.

> KP05: *We use Zumbani when our kids or any community member suffers from flu, coughs, or colds. Also, we ask the patient to rub the leaves between the hands until a heavy smell comes out then the person inhales it by bringing the rubbed leaves near the nose. We also boil the leaves and allow the patient to drink it while still hot until recovered… we believe that it can treat COVID-19*

IK holders also identified *Muruguru* (*Carissa bispinosa*) as another plant they use to treat coughs and colds.

> KP02: *We grew up eating porridge that was prepared with the extract*

of Muruguru. Its root was fermented with mealie-meal, this was then used to prepare porridge. The porridge will help to boost the immune system. Also we prepare an extract from the plant root by boiling it, then the patient drinks it while it is still hot.

Another plant which was highlighted was *Musekesa* (Figure 4).

Figure 4. ***(Musekesa) Piliostigma thonningii*** **(Source: KP05)**

The medicine is extracted from boiling leaves, bark and/or roots. The extract is used to treat cough and colds.

KP05: *We use three parts* (not combined)*: The roots, the bark, or the leaves. The part is boiled and given to the patient while still hot. The extract is very effective in the treatment of cough and colds.*

Mushavhi (*Ficus ingens), Mugamutiri* (*Eucalyptus camaldulensis) and*

muonde (Ficus sycomorus), were also mentioned and their active compounds, from pharmacological analysis, revealed several effects (antimicrobial, antiviral, analgesic, anti-inflammatory) to manage infectious respiratory diseases.

Theme 3: Transmission of Indigenous Knowledge

There is a rich repository of knowledge about ethno-medicinal plants and management of diseases in general. This knowledge has to be preserved and transmitted in a more sustainable manner in order to avoid it from being lost or forgotten (*Mail & Guardian*, 2 February 2018). In this section a description of how knowledge is preserved and transmitted amongst the Karanga IK holders is presented.

The Karanga knowledge holders emphasised that oral transmission is common amongst the communities. Knowledge is usually passed from the knowledge holder by word of mouth to the young and other community members.

> KP03: *We teach the young through folk stories, songs and games. Many times we often sit by the fire place during the evenings and tell our kids information about our family histories, great family heroes, roles that should be performed by different people at different ages, knowledge about taboos and scared places, information regarding plant healing. At times we gather with many kids from the same village where such information is shared. Traditional songs that promote our culture and heritage usually characterise such gatherings. Gamification of economic activities such as fishing, fruit gathering, and spirit medium as healers and community protectors, form part of the gathering.*

While they did not explain why oral tradition was valued, this excerpt reveals that cultural activities, involving songs, games and story-telling, which are a part of their culture, was a useful medium to teach IK. However, they bemoaned the destruction of common practices such as '*Dare*' that was used to have the boys, fathers, and grandfathers spending the evening at a particular place while the girls, mothers, and grandmothers would be in the kitchen. This was a spatial arrangement that allowed the sharing of crucial messages. They

also mourned the lack of interest amongst the youth to learn about their culture. They believed that the young are fully absorbed in their school work. This was identified as a serious challenge that needs to be addressed because the young are the future of any community; hence they must be equipped with such knowledge and pass it on to future generations. This is supported by the following excerpts.

> KP02: *The problem we have now is that the young are shunning traditional knowledge.They consider it backward. These days places such as Dare are no longer visible.*

We compare 'Dare' to the talking circle as highlighted by le Grange (2020). Learning is facilitated by affording each person an opportunity to speak and to check whether what was taught has been assimilated. The intersection between 'Dare' and the talking circle lies the setting. In the 'Dare' setting, the elders used to sit down with the young at specified sessions and knowledge was passed from the more knowledgeable down to the young. A respectful setting characterised the gathering, where every member was given the opportunity to share and inquire where necessary. A similar setting applies to a talking circle, where members of the group gather when they have something to discuss. A stick or an object is held by the person who is speaking while others listen. When the talk ends, the stick is passed to the next person to speak. The element of respect is observed, and no monopolisation of the discussion is possible. This creates a healthy learning environment which characterises indigenous pedagogies, and is being applied by some researchers in education (le Grange 2020).

Observations through field tours were identified as another way by which knowledge of plant healing is transmitted. The knowledge holders highlighted that members of the community who show an interest in herbal treatment (potential practitioners) are taught about herbs that relieve a particular ailment. A field trip is organised where the knowledge holder will show the person the herb and possibly taste it to prove that it was not poisonous. The knowledge holders value observation as a way of learning to protect people from the dangers of consuming poisonous herbs. Observations through field trips were also favoured to show the new practitioners where to find the herbs as well as how to harvest them responsibly. After the first field trip the new practitioners will be asked to prepare the extract or powder in the

presence of the experienced knowledge holder to ensure that the techniques are correct. This is supported by the following evidence from the IK holders.

> KP01: *We take the young into the bush and show them the real plant This is done to avoid mistakes that may lead to the use of poisonous plants.*

> KP02: *We also teach the young ones the correct ways of collecting herbs.*

The IK holders engage in demonstrations, imitation, and repetition, until the knowledge is constructed successfully by practitioners-in-training. The experienced IK holders, having gained the knowledge over time, serve as mentors. The knowledge available is a product of experience as well as trial and error. Organising principles of verification through repetition, inference, and prediction underpins both traditional and Euro-Western knowledge perspectives.

Family functions and public functions are used as platforms to pass on information from the knowledge holders to the community members. The IK holders noted that ritual and traditional functions where information was shared through dance and songs are now rare in their community. Currently they utilise any available opportunity to share the knowledge they have. In this era of COVID-19, the constraints brought on by social distancing were highlighted. However the availability of modern technology has since been leveraged as the IK holders indicated that help is available telephonically. The following excerpts support the above findings:

> KP03: *As we were growing up we used to learn many things through songs, dance and other games such as mahumbwe, zvidobi and magure.*

> KP04: *Things have changed. Common traditional practices are no longer possible but we take advantage of any occasion where people gather in numbers, and teach them about disease management.*

> KP05: *During this time of COVID-19 we use cell phones to communicate.*

The knowledge holders indicated that indigenous knowledge is intellectual property which belongs to the community. Most of this knowledge is not written down, but retained in the memories of the holders, songs, rituals, and in different items including healing plant specimens, traditional dresses, and paintings. They indicated that songs have survived the harsh academic spaces as most of the traditional songs are common amongst the school going children during sporting activities. However, the knowledge holders indicated that performing art as a way of passing knowledge is being distorted as it has been taken over by the school and words and corresponding dramatic movements were changed. The exclusion of IK by the school increases margins of division between the school and community, and IK holders within the community are aware of their peripheral positioning. This is supported by the following excerpts.

> KP03: *We get all the herbs that we use to treat different diseases from the bush. Our knowledge is not written down; we use songs and particular practices as the source and means of producing it and at times passing it on. The major problem is within the school system that excludes our knowledge. However, it's encouraging to note that many songs during sporting activities in schools are traditional ones.*

The role of the ancestral spirit as the source of information was highlighted. The IK holders have an understanding that their servitude is under the guidance of ancestral spirits. They believe that to remember or help any patient is through spiritual visitation by the ancestors that enable vision or wisdom of the available treatment.

> KP03: *Our work is the wisdom we get from our ancestors. The ancestors enable us to remember different herbs and at times we dream about medical plants that can be used.*
> KP04: *Lucky birds or insects usually lead us to places where there are new herbs or any form of treatment from nature. This is what our ancestors do for us.*

Our next task was to locate opportunities for incorporating IK holders' insights into the pre-service teacher education curriculum.

Theme 4: Synopsis of the Teacher Education Biology Curriculum Related to Infectious Diseases

The four year long teacher education program is intended for pre-service teachers who have completed Advanced level successfully. The modules in the teacher education biology programme include Bacteriology (level 2: semester 1) and immunology (level 1: semester 1) which are compulsory, while animal parasitology, microbial genetics and virology are elective modules. Each student is expected to register for elective courses totalling to 36 credits from 22 modules, each having 4 credits.

For the purpose of this study we focussed on bacteriology, animal parasitology, immunology, microbial genetics, and virology, as topics that address infectious diseases, considering the global nature of these infections, including the novel Coronavirus. Analysis was done to establish the inclusivity of IK in the module.

Table 1: Modules with topics that are related to infectious diseases and emerging ones.

	Bacteriology	**Immunology**	**Animal parasitology**	**Microbial genetics and virology**
Topics/ concepts related to existing infectious diseases	Aseptic techniques, sterilisation	Immunity structure and functions of antibodies, AIDS and HIV-immunological basis, Theory of vaccination	Parasitic arthropods; host specificity; host response and Defence; parasite evasion of immunity	Groups of animal and plant viruses, virus genetics and variability. Virus detection and serology

Topics which address possible emerging infectious diseases	Aseptic techniques, sterilisation, identification and classification of bacteria	AIDS and HIV-immunological basis, Theory of vaccination	Specimen collection and analysis.	Virus detection and serology
Topics related to the spread, prevention and treatment of emerging infectious diseases	Identification and classification	Theory of vaccination	Specimen collection and analysis	Virus detection and serology, detailed descriptions of the main genera, and groups of animal and plant viruses.
Practical methods to teach about infectious diseases (Pedagogy)	Laboratory-based investigation	Laboratory-based investigation	Laboratory-based investiga-tion	Laboratory-based investiga-tion
Epistemologies and pedagogies which are privileged	Euro-Western - e.g. princi-ples of aseptic techniques, sterilisation and exenic culture.	Euro-Western- e.g. experiments	Euro-Western-e.g. specimen collection and analysis	Euro-Western-e.g. genetic engineering in micro-organisms

Knowledge producers who are privileged	Euro-Western-	Euro-Western-	Euro-Western-	Euro-Western-
How has AIKS been infused into the teacher education biology curriculum, if at all?	No evidence	No evidence	No evidence	No evidence

The four modules have rich information regarding infectious diseases, for example theory of vaccination under immunology and virus detection under microbial genetics and virology. However, there is no topic that recognises IK as an alternative knowledge base from which infectious diseases can be addressed. Although most of the students emerge from rural communities within the same province, their indigenous knowledge of disease management is excluded. In microbial genetics and virology, the topic virus detection is covered. This equips pre-service teachers with skills relevant for teaching about identifying possible disease-causing organisms using experimental based techniques. Specimen collection is another topic that prepares pre-services to be in a position to use biological skills collecting samples specimen for identification in the lab. These approaches to disease management are important in any community, however the exclusion of IK in dealing with possible emerging infections is alarming.

The four modules address the principles of prevention and treatment of infectious diseases in detail, by drawing exclusively on Euro-Western framing of science education. This monolithic view suggests that there is a single episteme that is worthy of inquiry, and this represents the complicity of universities in perpetuating the muting of IK. The perspectives of IK holders are valuable and can and should be represented in the curriculum, in order to resonate with daily experiences of people, and to learn useful proactive and reactive methods of addressing infectious diseases. The IK holders identified a

number of approaches that are used for preventing and treating infections. For example, they discouraged sharing of utensils and clothes, encouraged hand washing and sanitisation, and encouraged use of cups with long handles (*mukombe*) to prevent contamination of water. In addition, they '*administered different herbs to our kids to boost their body defense so that they would not be affected by the infection so that they would not be affected by the infection and any other related diseases'* (KPO3), when they first heard about the outbreak of COVID-19. Also, '*The Chief opened the platform for us to share the relevant information regarding how respiratory infections were managed'* (KPO5). These are proactive measures to prevent infection. Socio-behavioural interventions, boosting immunity and education were privileged by IK holders to protect members of the community from infection.

An analysis of the module templates revealed that experimentation and lecture methods were privileged. As we highlighted IK methods of disease management using herbs are passed to the young through demonstration, field trips, storytelling, art and songs. This form of education occurs as an 'organic part of community life' (Dowyal *et al.* cited in Mandizadza *et al.* 2013). Storytelling and songs, as a repertoire of IK, have long been used as tools to teach about IK. Demonstration is common to both knowledge systems. However, in this study, the IK methods of teaching privileged direct observation, hands-on investigation, song, dance and paintings to impart their knowledge, that is, multiple intelligences were considered by offering a range of teaching and learning methods. The inclusion of these methods in the biology curriculum is recommended.

The immunology section comprises the biomedical perspective of disease management. The section includes how the body's immune system is attacked by pathogens, how the body responds to pathogenic infections, the ways by which the body's immune system can be enhanced to prevent pathogenic invasions, and HIV and AIDS. The pedagogy on how the content is to be taught involves laboratory-based investigations and reflects a Euro-Western scientific approach to the construction of knowledge. The content and pedagogy in the modules exclude IK. Therefore, there is no representation of indigenous knowledge and practices in the programme. This signals the dearth of African knowledge and African knowledge holders in formal HE. The Euro-Western perspective is being privileged over the AIK. This approach to knowledge dissemination is suppressive and destructive and signals ontological exiling of historically colonised groups.

The inclusion of HIV/AIDS is reflective of how the program tries to deal with pandemics. However, the silence on the use of IK in the management of HIV/AIDS is palpable considering how many African societies rely on herbal treatment for this disease (Mandizadza *et al.* 2013). This reflects the marginalisation of a knowledge system that is practiced intensely, and a promotion of practices that are foreign and in most cases, not relevant to disease management approaches of the local African people.

The microbiology, genetics and virology sections, like the immunology section is also a reflection of the Euro-Western knowledge system. The content is objective, logical and depersonalised. It lacks relevance to the life of the immediate community, since a large proportion of the population look to traditional IKS for their health care. The students are therefore prepared not to be problem solvers and participants in their immediate communities but rather to be service providers in an already established system.

Generally the programme has no components from IK in terms of both content and pedagogy. This resonates with the assertion by Morreira and Luckett (2018), that in order for one to initiate the decolonisation process, there is a need to think about what is absent, present and on the margins of the curriculum. In this case the Euro-Western knowledge canon is the only perspective that informs the biology modules for teachers.

Theme 5: Including IK into the Teacher Education Biology Curriculum

The objective of the program emphasises the need to produce graduates who will participate in addressing national problems and contribute to national development. In order for any development to occur it is necessary for graduates to understand the problems in their communities and establish ways of addressing those using locally available resources. The inclusion of IK into the modules could prepare the students (pre-service teachers) to solve problems by providing meaningful science education with which their learners identify. The existing course objective states:

> *After completing the programme, students should be able to: work in Biology related fields, carry out postgraduate studies in Biological*

> *Sciences and other related fields, provide solutions to environmental problems and participate actively in the development of the country.*

This objective is focussing on completion of the course, and applying skills to promote Euro-Western knowledge canon within careers deeply entrenched in western modern science. We argue that the program should provide skills relevant for survival in a community, and to produce graduates who are active in national development. As such we recommend the following alternative objective that is culturally inclusive:

> *Graduates from this programme should be able to address socio-cultural problems in an inclusive manner that takes cognisance of the potential embedded in multiple knowledge systems, and actively participate in the development of their immediate community and the country at large*

Unlike the current objective this alternative objective will allow the course to prepare the students to address immediate social problems in their communities, by tapping into the affordances of multiple knowledge systems.

Another way to include IK in the modules is to consider taking content from plant healing and including it in the program. For example, the concepts on bacteriology can be taught from both the African perspective and the Euro-Western perspective. There is dissonance in terms of causative agents, but the there is enough evidence from the pharmaceutical analysis that these herbs have antibacterial activities and they have been used from time immemorial to manage infectious diseases among indigenous communities.

The opportunity for introducing pharmacological and IK information related to the use of plants to treat infectious disease into the modules, is worthy of being pursued. Since these herbs are solicited from IK holders whose knowledge has been demonised and destroyed during the colonial era and continues to be marginalised, pharmacological evidence can be incorporated to motivate for and boost confidence in the potential of its usefulness. Far from being an act of secondary colonisation, this serves to enhance the knowledge about the efficacy of these plant remedies. We endorse the value of a plurality of knowledges, and discuss the chemical components of the plants used by the IK holders to treat coughs, colds, influenza, chest pains associated with respiratory conditions, and other infectious respiratory diseases.

The phytochemical analysis of *Mufandichimuka* (*Myrothamnus flabellifolius*) reveals that it contains alkaloids, flavanoids, phenolics, saponins, steroids and tannin (Molefe-Khamanga, Mooketsi, Matsabisa & Kensley 2012), anti-diabetic (Mothlanka & Mathapa 2012) and antimicrobial active ingredients. Therefore, we argue that although IK holders lack knowledge of Euro-Western scientific explanations, their indigenous wisdom which, for centuries, had been demonised, is useful to treat infections effectively.

In an attempt to discover the pharmacological characteristics of another plant which was favoured by the IK holders named *Zumbani*, Manezzhe, Potgieter and van Ree (2004) identified antimicrobial agents in the extract and hence its use as a remedy for cough and colds. The IK holders in our study claimed that it is one of the highly effective herbs in the fight against common colds and coughs, hence a potential remedy for COVID-19. The literature search on the pharmacological activities of *Muruguru* (*Carissa bispinosa*) proved that the extract has antiviral and diuretic activities, and lignans (Patel cited in Maroyi 2011), and can be used to treat influenza. Based on this concurrence between different knowledge systems about the efficacy of plants for health, we motivate for its respectful representation (le Grange 2016) in the teacher education modules.

Since IK is valued by the people in the community, once the knowledge is included into the program, IK holders can be invited to the university as resource persons to teach about their practices, products and beliefs. This would position them as legitimate knowledge producers within the academy and would disrupt the 'panorama of colonial imprints, alienation, hypocrisy and the politics of identity…' (Mandizadza *et al.* 2013:140) in the higher education setting. This could create the opportunity for lecturers to learn IK as well, because lecturers were educated in a Euro-Western education system. Therefore the inclusion of an IK holder as a resource person would accelerate the process of unlearning and relearning. Mignolo (2017) identifies the decolonial process as a coordinated effort therefore participation of lecturers in this call will enhance its success.

The use of field trips is crucial if students are to get hands-on information regarding IK in the communities. Field trips are common within the Euro-Western pedagogical strategies (Eden, Sharma, Roy & Joshi 2019) but were not mentioned in the module templates. Field trips can be done in conjunction with demonstration by the IK holder. The demonstrations could start with identification of medicinal plants, and continue with how the healing

parts are harvested, prepared and administered for specific infectious diseases.

Talking circles, storytelling, songs and paintings can be used to create culturally inclusive pedagogical strategies for teaching about infectious diseases. Generally, there are different ways of knowing, as there are different approaches to knowledge transmission, therefore, there is need to challenge the monopolisation of the curriculum by one knowledge system (Louie, Pratt, Hanson & Ottmann 2017). Smith (2012) advocates decolonising the curriculum through indigenisation.

6 Concluding Remarks

Decolonisation as a process of claiming epistemic justice is far from being a reality. Governments through their constitutions and ministerial policies, and universities with their mission statements, articulate a decolonial vision, yet this does not translate to curriculum change.

In re-imagining the biology curriculum to include knowledge of the Karanga, we began by examining the world view of the Karanga about infectious disease. Holistic views were presented, with disease being linked to misfortune and neglect of one's ancestors. Restoration of ancestral protection reflected the metaphysical aspect of healing. An ethno-medical approach, based on healing using plant materials, was the pragmatic strategy adopted by Karanga IK holders. Many plants were mentioned, and preparation of medicines, including dosage, was discussed. Socio-behavioural interventions such as isolation, social distancing, not sharing clothes and utensils, and practicing hygienic health practices, were emphasised by these knowledge holders. How IK holders teach apprentices was also highlighted. Songs, games, dance, and storytelling were among the ways in which teaching occurred. In addition, hands-on field trips, direct observation of plants, demonstration of sustainable harvesting methods and hands-on engagement in the preparation of medicines, were favoured as effective teaching methods. Throughout this process, the Karanga IK holders demonstrated their trust in, respect for and appreciation of inherited wisdom

Insights from our study reveal that teacher education modules can be rendered more culturally inclusive. This involves the deconstruction of university modules, in order to locate possibilities for inserting IK in terms of the 'what' (content), the 'who' (teacher) and the 'how' (pedagogy) of knowledge construction. The active search for IK, which resonates with

Chilisa's (2012) recovery and rediscovery, is crucial. In this study, insights from IK holders included a holistic worldview about disease, and practical methods to manage disease. Knowledge from IK holders about the types of plants and preparation of medicines from them, can be included in the modules. Parallel learning about pharmacological analysis of extracts from these plants, can supplement this information, and a plurality of knowledges can be embraced. The teaching methods involving field trips, cultivation, and harvesting of medicinal plants, and hands-on preparation of medicines, will serve to recentre African knowledge in the curriculum. Socio-behavioural interventions to manage diseases by indigenous people can also be included. Repositioning the IK holder as a teacher within the academy will restore the valuing of producers and facilitators of indigenous wisdom.

Creating a culturally inclusive approach would enable the unmuting of the rich repository of IK in the teacher education biology curriculum. This 'disruption of the epistemological status quo has the potential to shape their (student teachers') teacher identity' (Mudaly 2018:62), by drawing from the Karanga knowledge holders' ways of treating infectious diseases. Epistemic re-thinking (Matiwana 2017) from the Euro-Western canon is possible, if teachers become well versed in different ways of knowing. Respectful representation of IK (le Grange 2016) requires tapping into indigenous knowledge for its inclusion in the curriculum. Curriculum reconstruction can be realised through commitment and action (Chilisa 2012) to raise consciousness about the value of IK in solving contemporary problems and develop creative pathways to include IK into teacher education.

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References

Adnan, M., S. Ali, K. Sheikh & R. Amber 2019. Review on Antibacterial Activity of Himalayani Medicinal Plants Traditionally Used to Treat Pneumonia and Tuberclosis. *Journal of Pharmacy and Pharmacology* 71,11. Available at: https://doi.org/10.1111/jphp.13156 (Accessed on 10 June 2020.)

Annum, G. 2014. *Research Instrument for Data Collection.* Ghana: Kwame Nkrumah University of Science and Technology. Available at:

https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1857112 (Accessed on 20 June 2020)

Arenas, A., I. Reyes & L. Wyman 2012. When Indigenous and Modern Education Collide. *World Studies in Education* 8, 2: 33 - 64. Available at: https://doi.org/10.7459/wse/08.2.03 (Accessed on 08 June 2020.)

Brownlie, J. 2012. *The Birth of Southern African Centre for Infectious Disease Surveillance* 2 - 5. Available at: https://doi.org/10.4102/ojvr.v79i2.459 (Accsessed on 10 May2020.)

Chilisa, B. 2012. *A Postcolonial Indigenous Research Paradigm.* Cape Town: HSRC. Available at: http://www.hsrc.ac.za/uploads/pageContent/148/MicrosoftPowerPoint-CapeTownAPostcolonialIndigenousResearchParadigm.pdf (Accessed on 10 June 2020.)

Cook, T. 2012. Where Participatory Approaches Meet Pragmatism in Funded (Health) Research: The Challenge of Finding Meaningful Spaces. *Forum: Qualitative Social Research* 13, 1. Available at: http://dx.doi.org/10.17169/fqs-13.1.1783 (Accessed on 10 June 2020.)

Debprasad, C. 2018. Role and Scope of Ethnomedical Plants in the Development of Pharmacologyonline 3 : 64 – 72. *Newsletter Chattopadhyay* July. Available at: https://www.researchgate.net/journal/1827-8620 Pharmacologyonline. (Accessed on 15 July 2020.)

Dolphin, W. & D. Viek 2015. *Biological Investigations Lab Manuals.* US: McGraw-Hill Publishing Company.

Eden, G., S. Sharma, D. Roy, A. Joshi, N.J. Abdelnour & N. Rangaswamy 2019. Field Trip as Method: A Rapid Fieldwork Approach 1 - 7. https://doi.org/10.1145/3364183.3364188. Available at: https://www.researchgate.net/publication (Accessed 02 November 2020.)

Esmaeili, Z., A.A. Jahfar & S.M. Shahamiri 2015. The Role of Universities in Social Reconstruction. *Mediterrerian Journal of Social Sciences* 6:271. Available at:https://doi.org/10.5901/mjss.2015.v6n6s6p271 (Accessed 15 July 2020.)

Ezeanya-Esiobu, C. 2019. Indigenous Knowledge and Education in Africa. Available at: http://www.springer.com/series/13889 (Accessed on 08 November 2020.)

Fomunyam, K. G. 2017. Decolonising the Future in the Untransformed Present in South African Higher Education. *Perspectives in Education* 35, 2: 168

- 180 Available at: http://dx.doi.org/10.18820/2519593X/pie.v35i2.13 (Accessed on 23 July 2020.)

Govender, N. & G. Mutendera 2020. Teachers' and Custodians' Views and Dilemmas Arising thereof Regarding the Integration of Indigenous Knowledge in the Primary School. *AlterNative An International Journal of Indigenous Peoples* 1 - 13.Available at: https://doi/10.1177/1177180120970935

Hauser, V. & C. Matthews 2009. The Place of Indigenous Knowledge in Tertiary Science Education: A Case Study of Canadian Practices in Indigenising the Curriculum. *The Australian Journal of Indigenous Education* 38, 1: 50 - 63.

Heleta, S. 2016. Decolonisation: Academics must Change what they Teach, and How. Available at: https://theconversation.com (Accessed on 25 July 2020.)

Hess, J. 2015. Decolonizing Music Education: Moving beyond Tokenism. *International Journal of Music Education*, 33, 3: 336 - 347.

Horill, T., D.E. McMillan & G. Thompson 2018. Understanding Access to Health Care amongst Indigenous Peoples. A Comparative Analysis of Biomedical and Post-colonial Perspectives. *Nursing Inquiry* 25, 3. https://doi.org/10.1111/nin.12237. (Accessed on 2 November 2020.)

Ighodaro. O.M., S.O. Agunbiade, J.O. Omole & O.A. Kuti 2012. Evaluation of the Chemical, Nutritional, Antimicrobial and Antioxidant-vitamin Profiles of Piliostigma Thonningii Leaves (Nigerian species). *Research Journal of Medicinal Plants*. Available at: http://doi.10.3923/rjmp.2012.537.54 (Accessed on 02 August 2020.)

International Relations 2017. Interview with Walter Mignolo/ Part 2: Key Concepts. Available at: https://www.e-ir.info/pdf/67501 (Accessed on 2 November 2020.)

Jalloh, M F., P. Sengeh, R. Monasch, M.B. Jalloh, N. Deluca, M. Dyson, … & R. Bunnell 2017. *National Survey of Ebola-related Knowledge, Attitudes and Practices before the Outbreak Peak in Sierra Leone.* August 2014. Available at: https://doi.org/10.1136/bmjgh-2017-000285 (Accessed on 05 May 2020.)

Kaya, H.O. 2013. Integration of African Indigenous Knowledge Systems into Higher Education in South Africa: Prospects and Challenges. *Alternation* 20, 1: 105 - 134.

Kiti, P.C. 2013. Recentring Africa: From Paulin Hountonji to Meinrad Herbga.

Paper presented at the Meeting of the International Conference of Science and Indigenous Knowledge Project at University of Western Cape, Cape Town, RSA. Available at: http://www.scielo.org.za/scielo.php?script=sci_nlinks&ref=1559295&pid=S2520-98682018000400005000012&lng=en. (Accessed 18 July 2020.)

Kivunja, C. & A.B. Kuyini 2017. Understanding and Applying Research Paradigms in Educational Contexts. *International Journal of Higher Education* 6, 5: 26 - 41. Available at: https://files.eric.ed.gov/fulltext/EJ1154775.pdf (Accessed 08 November 2020.)

le Grange, L. July 2016. Decolonising the University Curriculum. *South African Journal of Higher Education* 30, 2. Available at: https://doi.org/10.20853/30-2-709 (Accessed 06 July 2020.)

Louie, D.W., Y. Pratt, A.J. Hanson & J. Ottmann 2017. Applying Indigenizing Principles of Decolonizing Methodologies in University Classrooms. Available at: https://doi.org/10.47678/cjhe.v47i3.187948 (Accessed on 12 November 2019.)

Mahabeer, P. 2018. Curriculum Decision-makers on Decolonising the Teacher Education Curriculum. *South African Journal of Education* 38, 4: 1-13.

Maldonado-Torres, N. 2007. On the Coloniality of Being. Cultural Studies 21,2 - 3: 240 - 270. Available at: https://www.tandfonline.com/doi/abs/10.1080/09502380601162548 (Accessed on 12 June 2020.)

Manathunga, C. 2018. Decolonising the Curriculum: Southern Interrogations of Time, Place. Available at: https://www.brynmawr.edu/sites/default/files/Manathunga%202018%20Decolonising%20the%20curriculum.pdf (Accessed on 22 July 2020.)

Mandikonza, C. 2019. Integrating Indigenous Lnowledge Practices as Context and Concepts for the Learning of Curriculum Science: A Methodological Exploration. *Southern African Journal of Environmental Education*. Available at: https://www.researchgate.net/publication/334255448_Integrating_indigenous_knowledge_practices_as_context_and_concepts_for_the_learning_of_curriculum_science_A_methodological_exploration https://doi.org/10.4314/sajee.v35i1.13. (Accessed on 2 November 2020.)

Mandizadza, E. & G. Chavunuka 2013. Traditional Medicine and HIV and AIDS Treatment: Challenges, Prospects and Lessons for Zimbabwe. In

Tizazu, G. & R. Mesfin (eds.): *Antiretroviral Treatment in Sub-Saharan Africa*. Ethiopia: Organization for Social Science Research in Eastern and Southern Africa.

Manenzhe, N.J., N. Potgieter & T. van Ree 2004. Composition and Antimicrobial Activities of Volatile Components of Lippia Javanica. *Journal of Phytochemistry.* Available at: https://doi.10.1016/j.phytochem.2004.07.020 (Accessed on 17 August 2020.)

Matiwana, B. 2017. Decomodification Thesis. Available at: https://nect.org.za/publications/dialogues-seminars-and-summits/the-decolonisation-of-south-african-schooling.pdf (Accessed on 2 November 2020.)

Maroyi, A. 2011. Ethnobotanical Study of Medicinal Plants Used by People in Nhema Communal Area, Zimbabwe. *Journal of Ethnopharmacology*. Available at: https://doi.10.1016/j.jep.2011.05.00 (Accessed on 17 July 2020.)

Maunganidze, L. 2016. A Moral Compass that Slipped: Indigenous Knowledge Systems and Rural Development in Zimbabwe. *Cogent Social Sciences* 2, 1: 1 - 12. Available at: https://doi.org/10.1080/23311886.2016.1266749. (Accessed on 12 May 2020.)

Mendelson, M. 2014. The Geography of Infectious Diseases in Africa: From Endemic Populations to Travellers. *International Journal of Infectious Diseases* 21, 12. Available at: https://doi.org/10.1016/j.ijid.2014.03.430 (Accessed on 05 May 2020.)

Mertens, D.M., F. Cram & B. Chilisa 2013. *Indigenous Pathways into Social Research.* New York: Routledge.

Mokgobi, M.G. 2015. Towards Integration of Traditional Healing and Western Healing: Is this a Remote Possibility? *African Journal of Health Education, Recreation and Dance.* Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4652795/ (Accessed on 20 July 2020.)

Molefe-Khamanga, D.M., N.A. Mooketsi, M.G. Matsabisa & R.M. Kensley 2012. Qualitative Phytochemical Studies of Solvent Extracts from Myrothamnus Flabellifolius. *Online International Journal of Medicinal Plant Research* 10, 6 - 7: 396 - 402. Available at: https://www.cogentoa.com/article/10.1080/23312025.2016.1275403.pdf

(Accessed on 23 July 2020.)

Morreira, S. & K. Luckett 2018. *Questions Academics can Ask to Decolonise their Classrooms*. Available at: https://www.researchgate,net/publication/339353855 (Accessed on 28 August 2020.)

Mothlanka, D.M.T. & G. Mathapa 2012. Antioxidant Activities of Crude Extracts from Medicinal Plants Used by Diabetic Patients in Eastern Botswana. *Journal of Medicinal Plant Research* 6, 42: 5460 - 5463.

Mpofu, V. 2016. *Possibilities of Integrating Indigenous Knowledge into Classroom Science: The Case of Plant Healing.* Unpublished thesis, University of Witswatersrand Johannesburg. Available at: http://wiredspace.wits.ac.za/handle/10539/20706. (Accessed on 12 July 2020.)

Msila, V. 2016. *Africanising the Curriculum: Indigenous Perspectives and Theories.* Available at: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2221-4070201700010000. (Accessed on 12 July 2020.)

Mudaly, R. 2018. Towards Decolonising a Module in the Pre-service Science Teacher Education Curriculum: The Role of Indigenous Knowledge Systems in Creating Spaces for Transforming the Curriculum. *Journal of Education* 74: 47 - 66.

National Institute for Occupational Safety and Health (NIOSH) 2020. Infectious Diseases and Circumstances Relevant to Notification of Emergency Response Employees: Implementation of Sec. 2695 of the Ryan White HIV/AIDS Treatment Extension Act of 2009. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2020 – 119. https://doi.org/10.26616/NIOSHPUB2020119external icon

Ndlovu-Gatsheni, S. 2015. Decoloniality as the Future of Africa. *History Campus* 13, 10: 485 - 496.

Ng'asike, J.T. 2019. Indigenous Knowledge Practices for Sustainable Lifelong Education in Pastoralist Communities of Kenya. *International Review Education* 65: 19 - 46. Available at https://doi.org/10.1007/s11159-019-09767-4 (Accessed on 12 July 2020.)

Ngulube, P., L. Dube & M. Mhlongo 2015. Towards a Cartography of Indigenous Knowledge Systems in Library and Information Science

Training and Education in Anglophone Eastern and Southern Africa. *Indilinga* 14, 2: 145 - 168.

Olusesan, A.G., O.C. Ebele, O.N. Onwuegbuchulam & E. J. Olorunmola 2010. Preliminary In-vitro Antibacterial Activities of Ethanolic Extracts of Ficus Sycomorus Linn. and Ficus Platyphylla Del. (Moraceae). *African Journal of Microbiology Research* 4: 598 - 601. Available at: https://academicjournals.org/journal/AJMR/article-full-text-pdf/63A372112374 (Accessed on 25 August 2020.)

Owen, G.T. 2014. Qualitative Methods in Higher Education Policy Analysis: Using Interviews and Document Analysis. *The Qualitative Report* 19, 26: 1 - 19. Available at: https://nsuworks.nova.edu/tgr/vol19/iss26/ (Accessed on 12 May 2020.)

Oyieke, J. & D.D. Galang 2016. Knowledge, Attitudes and Cultural Practices: Their Influence on Male Involvement in Reproductive Health. *Baraton Interdisciplinary Research Journal* 6: 139 - 149.

Ozioma, E.J. & O.A.N. Chinwe 2019. Herbal Medicines in African Traditional Medicines. *IntechOpen*. Available at: https://www.intechopen.com/books/herbal-medicine/herbal-medicines-in-african-traditional-medicine (Accessed on 20 August 2020.)

Pretorius, J.C., S. Magama & P.C. Zietsman 2003. Purification and Identification of Antibacterial Compounds from Euclea crispa subsp crispa (Ebenaceae) Leaves. *South African Journal of Botany* 69: 579 - 586. Available at: http://www.koreascience.kr/article/JAKO201108863884197 (Accessed on 23 August 2020.)

Qian, H. & V. Nihorimbere 2004. Antioxidant Power of Phytochemical from Psidium Guajava Leaf. *Journal of Zhejiang University of Science* 5: 676 - 683. Available at: http://doi.10.1631/jzus.2004.0676 (Accessed on 23 August 2020.)

Ritskes, E. 2012. What is Decolonization and Why does it Matter? Available at: https://intercontinentalcry.org/what-is-decolonization-and-why-does-it-matter/ (Accessed: 17 July 2020.)

Rosala, M. 2019. *How to Analyze Qualitative Data from UX Research: Thematic Analysis.* Available at: https://www.nngroup.com/ (Accessed on 16 October 2020.)

Sandabe, U.K., P.A. Onyeyili & G.A. Chibuzo 2006. Phytochemical Screening

and Effect of Aqueous Extract of Ficus sycomorus L. (Moraceae) Stembark on Muscular Activity in Laboratory Animals. *Journal of Ethnopharmacol* 103: 481 - 483. Available at: https://doi.org/10.1016/j.jep.2005.08.025 (Accessed on 17 August 2020.)

Sathorar, H. & D. Geduld 2018. Towards Decolonising Teacher Education: Reimagining the Relationship between Theory and Praxis. *South African Journal of Education* 38: 1 - 12. Available at: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-01002018000500005&lng=en&nrm=iso&tlng=en (Accessed on 12 July 2020.)

Smith, L.T. 2012. *Decolonizing Methodologies: Research and Indigenous Peoples.* 2nd Edition. New York, NY: Zed Books.

Van Wyk, B.E., A.M. Viljoen, M.E. Klepser, E.J. Ernst, D. Keele, E. Roling, S. van Vuuren, B. Demirci & K.H.C. Baúer 2002. The Composition and Antimicrobial Activity of the Essential Oil of the Resurrection Plant Myrothamnus Flabellifolius. *Southern Africa Journal Botany* 68: 100 - 105. Available at: https://academicjournals.org/journal/JMPR/article-full-text/68F6B7955291 (Accessed on 23 August 2020.)

Wach, E. 2013. Learning about Qualitative Document Analysis. *IDS Practice Papers.* Available at: https://www.researchgate.net/publication/259828893 (Accessed on 12 July 2020.)

Walton, E. 2018. Decolonising (through) Inclusive Education. *Educational Research for Social Change* 7: 31 - 45. Available at: http://www.scielo.org.za/pdf/ersc/v7nspe/04.pdf (Acessed 08 November 2020.)

Walwyn, D. 2018. The Role of South African Traditional Health Practitioners in the Treatment of HIV/AIDS: A Study of their Practices and Uses of Herbal Medicine. *Southern African Journal of HIV Medicine* 11, 2: 10 - 17. Available at: https://doi.org/10.4102/sajhivmed.v11i2.224 (Accessed on 20 July 2020.)

Kutenda Trinos
PhD Student
Science and Technology Education Cluster
University of KwaZulu-Natal, Pinetown
220108403@stu.ukzn.ac.za

Ronicka Mudaly
Associate Professor
Science and Technology Education Cluster
University of KwaZulu-Natal
Pinetown
mudalyr@ukzn.ac.za