Developing Teaching & Learning in Africa

Decolonising Perspectives

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Chapter Three

Decolonising Science: Challenging the South African Classroom through Indigenous Knowledge Systems

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From the Past to the Present: Demystifying Science

The search for a decolonised system of education has opened a myriad of debates in learning institutions. In South Africa, the Department of Basic Education is intent on decolonising the entire education system. Decolonising education refers to the accommodation of historically marginalised knowledges in preference of Western knowledges. Colonisation and apartheid in South Africa have over decades ensured that education for black people was always inferior to white education. Arguably, the inequalities evident in education today emanate from the history of segregation. Historically, black education suffered the consequences of the legacy of apartheid and colonialism. Bantu Education for blacks was meant to ensure that black people supplied labour for the South African economy. Christie (1988:12) quotes various apartheid leaders' perceptions of black education:

When I have control over native education, I will reform it so that natives will be taught from childhood that equality with Europeans is not for them.

H.F Verwoerd, 1953

We should not give the Natives any academic education. If we do, who is going to do manual labour in the community?

J.N. Le Roux, 1945

None of these two leaders would have supported science education for black children. In fact, the Eiselen Commission on Native Education in 1949 recommended the intensification of reforms in black (Bantu) education. This Commission was appointed by government to investigate aspects of native education. Among others, the Eiselen Commission pointed out that Bantu Education is different from education and it was established to ensure that it fits into the doctrine of white supremacy. "The African must understand that European civilisation in its broadest sense is closed to him, and his learning of culture must be confined to the primitive culture of his life in the reserves" (Federation of South African Women, 2013:2).

Today, in historically black schools, teachers are still faced with the challenge of demystifying science and in a time of decolonisation debates, explore ways of injecting African indigenous knowledges as well. As cited by Msila in the Preface, Macedo (1993) discusses the *Pedagogy of Big Lies*, which points out that poor children cannot succeed in school because of their socio-economic status. Yet when people speak of decolonisation, they seek to see schools as correctors of socio-economic equality and social injustices (Bude, 1985). Historically, black children in historically black schools have not fared well in Mathematics and Science and this is no wonder when one looks at the objectives of apartheid education highlighted above. In the past unqualified and underqualified teachers taught these subjects due to a shortage of qualified teachers in these learning areas. In historically black schools today, many teachers may believe in the pedagogy of big lies; that learning areas such as Mathematics and Science are not for poor children because of their low social capital.

The objectives of this chapter are to explore how a decolonised system has a potential of demystifying science, thus making it relevant to the learners' life world. The chapter seeks to investigate the role that can be played by Indigenous Knowledge Systems and linked to this is language, which is usually seen as a purveyor of culture. The use of the learners' knowledge from home can be beneficial for not only Science but also all knowledge in schools. Naidoo and Vithal (2014) point out that, in South Africa, Indigenous Knowledge Systems (IKS) play a critical role in Natural, Physical and Life Sciences and they are part of the Department of Basic Education's policy. Furthermore, these authors claim that the inclusion of IKS provides motivation and self-esteem, cultural responsiveness and relevance, increased peer interaction, as well as positive learning experiences. Van Wyk (2002:311) perceives a new space for IKS in South African schools today as he avers:

IKS therefore posits a critical choice of frameworks (Odora-Hoppers, 2000:8) to assist educators to become aware of the cultural space (Prakash & Esteva, 1998:30) of learners and how they may be able to bridge the distance that separates them from their learners. Science and technology educators could develop a new consciousness or awareness of the value of integrating their learners' way of seeing and way of being (Odora-Hoppers, 2000:6) with existing paradigms and epistemologies used in science and technology. [...] IKS embodies ultimately a pedagogy that fosters cultural, social and identity criticism to validate the centrality of the learners' experiences [...]

Conscientious educators who want to enhance science education in South African classrooms will try to adopt a correct consciousness that would promote the ideals of IKS-focused education. All African schools need a critical pedagogy that would democratise and humanise education.

Towards IKS Science: A Search for a Humanising Pedagogy

In his seminal work, *Pedagogy of the Oppressed*, Paulo Freire (1970) explores ways of achieving liberatory teaching and learning. Freire writes about a need to avoid the banking model in education and supports a system where the learner is in charge and not following rote learning. Freire seeks to see education as that which empowers. Mackinlay and Barney (2012) cite Smith who argues that decolonisation empowers indigenous people to "reclaim, re-name, re-write and re-right and in a similar vein Fanon asserts that decolonisation is not a formal administrative term, but rather a restructuring of subjects of history into agents of history". Science classrooms that promote IKS will have to lean towards critical pedagogy that will need to be embraced by both teachers and their learners. Paulo Freire used the term *conscientizacao*, a Portuguese term that was later translated into English as *conscientisation*. Conscientisation is a refusal to domestication – the learners take charge of their own learning. Macedo (2017) sees conscientisation as an antidote to banking education. For many years, due to their supposed difficulty, learners have been using the banking model to study science as well as mathematics. These subjects were mystified for both teachers and their learners. The search for a decolonised science curriculum may be a search for conscientisation where IKS will be utilised to reveal the learners' active reality. Science needs to conscientise the learners, thus showing them how they can effect changes in their environment. The actual practice of teaching Science needs to reflect the embrace of conscientisation. Conscientisation also

promotes humanising pedagogy, which regards every learner an agent of change. Unfortunately, for many poor learners in historically black schools dehumanising education pervades. Macedo (2012) writes:

The banking model of education is largely supported by instrumental literacy for the poor, in the form of a competency- based approach, and the highest form of instrumental literacy for the rich, acquired through higher education in the form of professional specialization. However, despite their apparent differences, the two approaches share one common feature: they both prevent the development of critical thinking that enables one to 'read the world' critically and to understand the reasons and linkages behind the facts and behind what may appear seemingly obvious but remain ill understood.

The banking model of education cannot address pedagogy based on indigenous knowledges. In his entire work, Paulo Freire perceived the role of effective education as transformative and able to bring social change. Teachers who are not prepared for this will not be able to change the society. In *Pedagogy of the Heart*, Freire (1998) points out that, for education to be transformative, it needs to have scientific and professional development. The dialogue required in IKS inspired education will furnish this, as education will accommodate all voices as knowledge is shared in classrooms that are opposed to teacher-centred classrooms where the teacher is the sole expert.

Shirley (2017) speaks of indigenous social justice pedagogy (ISJP) which has a huge role in Indigenous nation building. For a country such as South Africa where there are efforts to redress past imbalances brought about by colonialism and apartheid, social justice pedagogy is crucial in this regard; it is relevant because it supports deep social transformation. Shirley (2017:165) posits:

Social justice pedagogy is rooted in the educational frameworks of multicultural education and critical pedagogy (Cammarsta, 2011; Chapman & Hobbel, 2009). Multicultural education includes multiple dimensions that aims to support the practical component of providing equitable learning opportunities for all students through the curriculum affirming diverse student identities and experiences (Grant & Sleeter, 2007). Critical pedagogy critique the dominant knowledge within curriculum, critically examines inequities in society...

Indigenous social justice pedagogy is an endeavour to rethink schooling for indigenous learners. The main objective of this pedagogy is to reframe curriculum and the aim is to preserve indigenous epistemologies (Shirley, 2017). This pedagogy is a human rights-based model and is built upon the principle of humanising pedagogy that liberates. There is collaboration with indigenous peoples in

education setting by addressing the nearness between critical pedagogy and race including the cultural and political aspects of indigeneity (Falcon & Jacob, 2011). In numerous countries, schools have become diverse and teachers have to cope with the uncertainty as they teach in schools of increased cultural and ethnic diversity (Wiltse, Johnson & Yang, 2014).

African Experiences – Brief Literature Review

Literature around Africa demonstrates that the time for decolonisation of not only science but also all learning areas has arrived. The impact of Western knowledge is evident in the entire Africa and the pace to transform varies from country to country. There are many similar challenges when it comes to the introduction of IKS in schools. Among these are teacher apathy as teachers show negative predisposition to indigenous knowledges. The literature below shows how several hindrances delay the introduction of IKS in African classrooms. Despite the challenges though, there is evidence of many schools who are trying against the odds to include the local content in education.

Researchers around Africa have explored the use of Indigenous Knowledge Systems in classrooms. In one study by Erinoshio (2013) it was found out that in Nigerian secondary schools teaching methods that include indigenous scientific knowledge are beneficial for reinforcing learning. Furthermore, Erinoshio points out that learners understanding of the scientific concepts and were excited in their interaction with local resources. Erinoshio (2013:1141) also points out:

The benefit of contextualizing school science within indigenous scientific knowledge might be in the dynamics of the instructional environment that is more open, flexible, and interactive. Teaching science with such resources helped students to see the relevance and applicability of the subject content. For instance, the local cloth weaving (asooke) provided practical resource to simplify the concepts of tension, gravitational force, and circular motion also had a chance to see inaction practical use of lever system, incomplete burning, flames and tensile strength at the blacksmith site.

Ugwu and Diovu (2016) discovered that schools that integrate indigenous knowledge and Western knowledges in teaching Chemistry would achieve success. Ugwu and Diovu point out that indigenous knowledge and practices combined with effective teaching and learning lead to improved academic achievement. Writing about Kenya, Owuor (2008) argues that sustainable development can be attained in Africa when indigenous knowledges are infused in school curricula. She states that IKS will address knowledge deficiencies as it challenges the

dominance of Western knowledge in Kenya's school system. Furthermore, Owuor (2008) declares that IKS has become central in global discourse as a strategy to social, economic, and political challenge in African countries. Communities need to be more involved in decision making in education to uphold sustainable development. "Part of what is stressed in these is the incorporation of cultural heritage and values as the grounding for education, perpetuated through indigenous language" (Owour, 2008:34). Owuor maintains that, in Kenya, the cultivation of individual's responsibilities to their communities becomes a critical objective of the teaching and learning process in indigenous education.

Tsindoli, Ongeti and Chang'ach (2018) present an example of IKS when they point out that schools can derive knowledge from the Luhya tradition in Kenya, which has a variety in traditional decorations, weaving, constructions, games, and storytelling. These writers also add that indigenous mathematical knowledge can be infused in the Mathematics curriculum for effective understanding. Ng'asike (2019) posits that IKS can address issues of relevance in education. He adds that the nomadic Turkana who live in the Northwest of Kenya, their children underperform in schools. Ng'asike attributes this underperformance to inappropriate instruction materials used because these do not reflect the pastoralist children's local indigenous culture and environment.

Zimbabwe and Malawi, like many other African states, also tend to follow Western-oriented education where IKS is marginalised and negated. Hapanyengwi-Chemhuru and Makuva (2017) claim that in Zimbabwe just like in Malawi, education tends to be too colonial and still marginalises indigenous education; there are also few attempts to indigenise education. According to these writers, education still imitates European education or Western knowledges. More research in these countries need to be conducted to ensure that the introduction of IKS is not superficial. Hapanyengwi-Chemhura and Makuva (2017:93-93) assert:

In other words, there is need to go beyond technology related knowledge. What the Malawian experience shows is that the curriculum developers are ignorant of what is or what to include under IKSs. In the Malawian example, which is similar to the Zimbabwean experiences, the teachers perpetuate negative perceptions of IKSs by focusing on the negative aspects of taboos instead of engaging their positive aspects such as why they were in place in the first place. Kayira (2013:7) criticises the privileged position of western knowledge in Malawian schools pointing out "presently, Eurocentric science has the power and influence in the school science curriculum but is largely irrelevant to Malawian villagers."

Therefore, whilst education policies in various African countries support the introduction of indigenous knowledges, there appears to be not much done to attain this goal. Yet, some experts in various countries point out that teachers also make it difficult for the acceptance of indigenous knowledge in classrooms because they are unwilling to integrate IKS in their classrooms (Shizha, 2008). Teachers' reluctance impact negatively on the learners' engagement with science. Shizha (2008) explicates that many learners in Zimbabwe are not competent in school science due to pedagogical methodologies and practices that alienate learners from their experiential knowledge.

Outside Africa, there has been intensified attempts by certain governments to indigenise the education system when it comes to science education. The Australian parliament supports the inclusion of indigenous knowledges and 2017 was the year they marked the 50th anniversary of the 1967 referendum on Indigenous Affairs Policy (Carroll, 2017). Furthermore, Carroll (2017) highlights the 2013 report entitled, *Indigenous Engagement with Science: Towards Deeper Understandings*, which underscored that "there are significant opportunities for government and industry to engage with indigenous people in a way that will maximise the potential for increased productivity across a wide range of scientific activity".

Wohling (2009) points out that, in recent decades, indigenous knowledge has been recognised as contributor to natural resource management. Wohling also adds another dimension to the debate by pointing out that people should not accept indigenous knowledge uncritically thus blind to the shortcomings. This author also emphasises that the Australians do not debate limitations of IKS especially with regard to natural resource management. Researchers and government should not be prescriptive because the voices of indigenous people tend to be lost; thus, many indigenous people find themselves not being able to contradict, question or disagree with researchers (Wohling, 2009).

Yet, Hill, Grant, George, Robinson, Jackson and Abel (2012) contend that indigenous peoples in Australia have used several decentralised approaches to environmental management where they integrate indigenous knowledge and Western science to promote cultural diversity in the upholding of social-ecological system. Robbins (2018) also mentions one example of how ecologists in Australia are learning from indigenous people as land managers have collaborated with the native people to control fires. Robbins (2018) cites Gammage who states that long before colonisation in Australia, the natives managed the landscape with "fire and no fire" and this is what was referred to as "fire stick farming". Gammage lists

five stages of indigenous use of fire: controlling wildfire fuel; maintaining diversity; balancing species; ensuring abundance; and locating resources conveniently. The early settlers acknowledged the skill of indigenous used to control fire.

Writing about New Zealand, Harmsworth (2002) points out that the concept Maori Sustainable Development is a term reflecting the aspirations of contemporary Maori. This is Maori IKS, which describes Maori values, cultural identity, and purpose. The knowledge retains and emphasises the use of Maori knowledge. The Maori, like many other nations around the world, are trying to combat colonisation vestiges and cultural domination. Maori aspirations have been enhanced in New Zealand by focus on one or more of the following: improved Maori well-being and standards of health; increased human and social capacity; strength of cultural identity; sustainable management of natural resources; and culturally appropriate strategies for economic growth (Harmsworth, 2002).

Van Driessche (2013) discusses how some of the above is retained by New Zealand schools to preserve the Maori culture. In New Zealand, not only is Indigenous Knowledge Systems of the Maori taught to Maori schools – there has been initiatives to teach Maori IKS to non-Maori learners as well (Ministry of Education, 2007). The Maori continue to utilise their knowledge systems, their values in their curriculum. They use their education system to promote cultural values and indigenous knowledge to sustain it in their youth (Van Driessche, 2013).

IKS in Science Classrooms: Aiming at Critical Pedagogy

In one meeting we attended, a mathematics professor explained that it is unthinkable to speak of decolonising the ‘hard sciences’ such as Mathematics and Science. He went on to say that the formulae remained the same and that these sciences are not like history or any field in the humanities. Yet when we talk about decolonising a learning area such as mathematics, it refers to the transformation of teaching methodology – ensuring that mathematics is accessed by all and not meant only for ‘top-students’. In fact, Mathematics and Science in schools has been reserved for certain elite students and schools have used this for creaming purposes. Top learners are made distinct from the rest because they excel in Mathematics and Science. The decolonisation of science education would open doors and enable all learners to access education irrespective of their social background. Musitha and Mafukata (2018) posit that decolonising basic education is perceived as a catalyst to create human capital that will promote economic development to end poverty. Furthermore, the quest for decolonised education system is the

search for sustainable society. Uleanya, Rugbeer and Olaniran (2019) assert that restructuring the educational system to suit the needs of society will raise a sustainable developed society. Therefore, it is critical for the educational system to be fashioned or reinvented before the society can experience new and sustainable development. Additionally, Tikly (2019) points out that if education is to play a transformative role, it ought to be re-oriented and harnessed to wider processes of economic, cultural, and political transformation in the interest of social justice. Conscientised science teachers should always try to address the transformative agenda. As pointed out above education needs to produce fecund learners instead of perpetuating cultural and linguistic epistemicide (Tikly, 2019).

IKS refers to the ways or practices that indigenous people have always been exposed to as part of their everyday living. It includes knowledges that were marginalised hence not found in any reading material or textbooks. Keane (2015) refers to IKS as that which includes “a local community’s traditional technology; social, economic and philosophical learning grounded in spirituality skills and ways of being in nature”. Khupe (2014) describes IKS as an integrated pattern of human knowledge, beliefs, and behaviour. Furthermore, Khupe adds that language; ideas, beliefs, customs, taboos, rituals, ceremonies, folk stories, artefacts, and techniques are all part of IKS. Indigenous Knowledge Systems are values passed from generation to generation; they are the reason for the survival of the community under the guidance of elders and leaders. IKS have over decades proven to society that communities in Africa and various abodes of indigenous people that people had their own practiced sciences.

Over the years, there has been negative notions in describing Indigenous Knowledge Systems as Western scientists tend to regard IKS as not adequately scientific. Shizha (2008) states that there are varied meanings as IKS is based on cultural, social, political, and ideological definitions. “The fashionable perspective about indigenous knowledge has been that of uncoded knowledge that is often generally considered not compatible with positivists methods and not compatible with modern Western science” (Shizha, 2008:80). Mazzocchi (2006) emphatically states that Western science and traditional knowledge although different forms of knowledge, can glean much from each other. This is a fact that education planners, communities, teachers, and all education’s role players should understand. Wisdom in traditional societies has been passed from generation to generation and the fact that much of these were not written does not make them empty knowledges.

Mazzocchi (2006) explains that European colonisation has nullified and lampooned traditional knowledges and replaced these with Western educational and cultural systems. Yet, there is now the realisation that IKS is an important part of humankind's cultural heritage and this knowledge is critical for our future. There needs to be constant dialogue between IKS and Western knowledges, and in decolonisation terms we may refer to this coexistence as forging a planetary system where historically marginalised knowledges are also brought to the centre to inform education. In science, there are many complex issues that need to be attended and the combination of IKS and Western knowledge are pertinent in addressing these complexities (Mazzocchi, 2006). The Western tradition of thinking generates certain approaches in dealing with complexities but it is also equally crucial to learn how IKS explain such complexity (Mazzocchi, 2006).

Figure 3.1 IKS Transmission in a Science Classroom (Ramadikela et al., 2019)

In Figure 3.1, we illustrate how IKS can be transferred from the community to schools and demonstrate how the knowledge can enable learners to understand their reality as they make sense of science. At the centre is the use of both African epistemologies as well as Western epistemologies. The problem with colonised education system is that it excluded or marginalised other knowledges. For example, we read above how apartheid education marginalised the African knowledges of black people under Bantu Education.

Teacher Expertise and Indigenous Knowledge Systems (IKS)

Carter (2011:314) cites Anderson who states that science education needs to change the learners' ways of learning has to be changed as well as how teachers teach. It is clear from the discussions above that teachers utilising IKS in classrooms need some preparation and first they may need to unlearn the notions of IKS as inferior and Western science as credible and scientific. Teacher professional development programmes would need to introduce pre-service and in-service teachers to the paradigm of multicultural science learning and teaching environments (Mhakure & Mushaikwa, 2014). These authors also point out that teacher education research should enhance schooling in marginalised and diverse communities. New teaching models should serve diverse communities. Mhakure and Mushaikwa (2014:156) argue that science teachers should form teacher identities by facilitating teaching and learning activities, "such as reflecting on practice and empowering decision making through action research, thus leading to the creation of a positive and personally meaningful teacher identity, since this empowers teachers". This means that science teachers for today's classrooms must prepare to teach in diverse environments.

Teachers in traditional science might take time to embrace IKS in their science classrooms. Hewson (2014) contends that the teaching of science in South Africa is a disappointing failure. She states that there is a disconnect between two systems of knowing the Western and IKS. Figure 3.1 above demonstrates the synergistic approach that science teachers should strive for. Hewson (2014) also cites Hernandez et al. who suggests science teachers need a model of culturally responsive teaching that involves content integration, knowledge construction, prejudice reduction, social justice, and academic development. Working on teacher beliefs is critical for science teachers. In their study on science teachers, seeking identities Mhakure and Mushaikwa (2014) discovered the following as critical emerging themes about teacher beliefs about indigenous knowledge and Western science:

- o Got freed from bondage of thinking that only Western Science has all the solutions to human problems.
- o Some science concepts can be taught from indigenous knowledge. There is science in indigenous knowledge.
- o Belief in multicultural sciences.
- o Science is invasive, therefore it must be taught within learners' social-cultural context.
- o Science is a human enterprise and it is contextual.
- o Science has limitations just like indigenous knowledge.
- o Successful integration of indigenous knowledge and Western science should focus on in-service teacher training – a change of mindset with regard to indigenous knowledge.

Teachers who attempt to use IKS must have the above beliefs to be successful indigenous knowledge advocates and IKS teachers.

Conclusion

The era to decolonise education and infuse IKS in the curriculum has arrived. It is so critical that education authorities in Africa and everywhere where there are historically, marginalised indigenous people should embrace transformative models of education that would promote not only social change but social justice as well. IKS are among these transformative models. Education that only has Eurocentric models can never be adequate to initiate social change. Furthermore, education that involves all citizens will address social justice and dignity as it humanise the former oppressed or marginalised. Models explored from various countries above demonstrate the need for innovative IKS inspired models would be enriched by the integration with western science. What teachers need to take into cognisance though is that when they approach indigenous knowledges, they must think of indigenous social justice pedagogy. As Freire (1970) points out, education is a political act and when one thinks of transformation and social change, it has to be to what extent indigenous knowledges in classrooms can change the society.

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