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LIFE SCIENCES TEACHERS' UNDERSTANDINGS OF INTEGRATION OF INDIGENOUS KNOWLEDGE WHEN TEACHING BIODIVERSITY OF PLANTS

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Abstract

Although the South African Curriculum and Assessment Policy Statement (CAPS) document embraces local Indigenous Knowledge (IK), it does not specify how this should be implemented in the classrooms. As a result, little to no integration of IK is enacted in many of the Life Sciences classrooms. It is against this background that the study reported herein explored Grade 11 Life Sciences teachers' understandings of IK when teaching biodiversity of plants and related concepts. This study employed a qualitative research approach, which is underpinned by the interpretive paradigm. A case study research design was employed. Data was collected from five purposefully selected Grade 11 Life Sciences teachers in the Nkangala District in Mpumalanga, one of the nine provinces of South Africa. The selection of the participants was largely because they were easily available and that they were Grade 11 Life Sciences teachers at the schools where they were teaching. The teachers had a wide range of teaching experience (at least five years), meaning that they were assumed to be familiar with the CAPS document requirements on the integration of IK into teaching and learning process and the implementation gaps thereof. To generate data, open-ended interviews were employed. Each teacher was interviewed twice, firstly to determine their conceptualisation of IK integration, and secondly to explore their understandings of the integration of IK when teaching the topic Biodiversity of plants and related concepts. Vygotsky's social constructivism was adopted as the theoretical framework informing the data collection methods that addressed the research question. The data was analysed using the constant comparative method and three themes emerged from the patterns depicting teachers' understandings of the integration of IK when teaching biodiversity of plants and related concepts in Grade 11 learners' classrooms. Firstly, the findings of the study revealed that teachers understood the integration of IK as an effort to mainstream IK so that it could be given the same recognition as Western knowledge. Secondly, teachers viewed integration of IK as an additive to Western knowledge and not as a standalone legitimate form of knowledge. Thirdly, teachers viewed integration of IK as a way of fostering empowerment and justice to the marginalised communities who strive to utilise their own community heritage to solve own problems and develop their families and communities. The findings have implications for both teacher professional development and classroom practices.

Keywords: *Biodiversity of plants, grade 11 teachers, indigenous knowledge integration, life sciences, teachers' understandings.*

1. Introduction

The past decade witnessed several international voices calling for the inclusion of indigenous knowledge in the Life Sciences classrooms. The South African education system is no exception. There is emphasis in the Curriculum and Assessment Policy Statement (CAPS) on the integration of indigenous knowledge in science teaching and learning, aimed at achieving better learner understanding and therefore enabling learners to appreciate the affective dimension of science education (Department of Basic Education, 2011). This epistemological border–crossing, between science and indigenous knowledge hold many affordances for science education.

Various views exist about what IK entails. Khupe (2014) describes IK as specific forms of knowledge that is local, specific to place and could be synonymous to ways of knowing. The claims regarding the inclusion of IK in education is substantiated based on insights from neurobiology, and embodied, situated and distributed cognition (Wilson, 2002). Distinctions between perception, cognition and action (mind, body and world) have changed over the last number of years. Cognition is not only

embodied (brain embedded in the body) and situated (in an environment), but also distributed among agents (people) artefacts and external structures (Hardy-Valee & Paytte, 2008). The mind must be understood in the context of its relationship to a physical body that interacts with the world. The authors argue that capitalising on the cultural context of the learners holds affordances for more meaningful science education. While promoting IK, teachers should consider the fact that South Africa is a multicultural society. In the same classroom, learners from different cultural backgrounds and different social settings together engage in the learning process. Multicultural education does not alienate learners from their own culture, rather it enables learners to have a broader view and respect for other cultures without losing their roots (Pius, 2005). By including IK in education, recognition is given to diverse ways of knowing as well as the value of IK. However, research shows that teachers do not have the pedagogical content knowledge to incorporate IK in their teaching (De Beer & Van Wyk, 2012). Consequently, the current study sought to explore Life Sciences teachers' understandings of the integration of IK while teaching biodiversity of plants and related concepts in Grade 11 learners' classrooms.

2. Literature review

Teachers play a pivotal role in curriculum planning and implementation since they determine the success of any curriculum innovation. According to Keane, Khupe, and Seehawer (2017) several studies show that most teachers especially science teachers from all cultural backgrounds in South Africa have their own reservations about integrating IK in classrooms because they perceive Western science as being more powerful than IK. An example is of a study in KwaZulu-Natal Province where teachers admitted that they had never thought of introducing IK into their classes owing to their concerns about finishing the formal Western science curriculum in time and the heterogeneous cultures of their classes which poses challenges in respect of selecting the IK to teach (Keane, Khupe, & Seehawer, 2017). In sharp contrast to the assertions by the teachers, Keane et al. (2017) reiterates that in another study elders in South African communities complained about the irrelevance of the formal school curriculum of the Western science as they argued that for the improvement of the school curriculum through integration of traditional culture.

Similarly in a critical analysis to determine problems primary school teachers in Zimbabwe encountered when incorporating IK into science teaching, Shizha (2007) found that teachers' negative attitudes towards IK is the major inhibiting factor towards the incorporation of IK into the formal school science curriculum. Teachers in Shizha's study completely dismissed the integration of IK. For those teachers, social knowledge or cultural knowledge had no place in the teaching of science. The teachers saw Western science as rational, dynamic, and more modern, while IK was viewed as being static, traditional, and coming from a mythical African continent whose cultural forms should be civilized or corrected (Shizha, 2007). The teachers alluded to the hierarchical structure of science, where Western science occupied a superior hierarchy than indigenous science. Such negative attitudes of teachers towards IK are a big barrier for the incorporation of IK into the school curriculum, especially if such incorporation is not guided by policy or curriculum reform process.

3. Methodology

3.1. Research design

The study followed a qualitative case study research design (Creswell, 2014). It was underpinned by the interpretive paradigm () which allowed the researcher to write thick descriptions (Cohen, 2011). Cohen (2011) adds that while qualitative data often focuses on lesser numbers of people compared to quantitative data, the data tend to be in depth and rich. Though qualitative studies do not lead to data that can be generalised, they yield data collected from naturalistic settings situated in the backgrounds in which the phenomenon is being studied (Rallis & Rossman, 2003).

3.2. Selection of the participants

This study was a small-scale study consisting of five Grade 11 Life Sciences from the Nkangala District in the Mpumalanga Province of South Africa. The five were selected using convenience and purposive sampling (Cohen, 2011). Convenience and purposive sampling can be used by the researcher to select the most easily accessible candidates possessing the desired characteristics (Cohen, 2011). Their selection was largely because they were easily available and were teaching Life Sciences at their schools. The selected teachers had taught for at five years within their schools hence they were deemed knowledgeable about the surrounding respective communities and their indigenous practices and were familiar with the Curriculum and Assessment Policy Statement (CAPS) requirements on the integration of IK into the teaching and learning of Life Sciences.

3.3. Data collection

Data was collected through interviews. Each teacher was interviewed once using an open-ended interview schedule to explore teachers' understandings of the integration of IK when teaching biodiversity of plants to Grade 11 learners. Open-ended interviews allowed the respondents to express their feelings, attitudes, and understanding of the subject (Creswell, 2014). All the interviews were conducted outside teaching time in a quiet venue to avoid distractions and disruption of the teaching and learning process. Interviews were audio recorded with permission from the participants so that information could not be lost.

3.4. Data analysis

Interview recordings were first transcribed verbatim. The data was then was analysed using the constant comparative method (Merriam & Tisdell, 2016) which is an analytic procedure closely associated with the grounded theory. Grounded theory is a package of research methods that includes recent data collection, analysis, categorising, theoretical sampling, coding, constant comparison, comparing, memoing, saturation and promoting quality standards (Diaz, 2021). Constant comparative method of data analysis is an interactive and reflective process that begins as the data is being collected rather than at the end when data collection is finished (Stake, 2000). Therefore, data collection and analysis occurred concurrently. Analysis therefore involved identifying patterns in and reasons for the ways in which events happened (Henning, Van Rensburg, & Smit, 2004). The themes that were formed were used as the basis for argument when discussing and interpreting the data in relation to the research questions.

4. Research findings

From data analysis three themes emerged in response to the research question. Each theme is presented under the three upcoming subsections.

4.1. Theme 1: Teachers understood IK integration as a way of legitimizing it

The findings of the study revealed that teachers understood the integration of IK as an effort to mainstream IK so that it can be given the same recognition as Western knowledge. They understood that specific aim 3 of the CAPS document for Life Sciences focuses on the need to integrate IK in Life Sciences to ensure learners appreciate the relevance and applicability of the learned scientific concepts in their lives. This is evident from the following teacher's response.

Mrs Welman: *IK in Life Sciences teaching and learning attempts to legitimise local knowledge and establish a niche for IK in the overall education system focus. Learners need to understand that what they are taught as "Science "is not something created out of nowhere. So, integrating IK will allow learners to involve their parents or other members of community when they do their research on a given topic, to incorporate cultural knowledge and practices.*

4.2. Theme 2: The teachers viewed integration of IK as an additive

The integration of IK in Life Sciences was understood by the teachers to be an addition to the Western knowledge that is taught at school. This is reflected in the response by Ms Mahlangu who view the integration of IK in life sciences teaching and learning as follows:

Ms Mahlangu: *IK adds to the western knowledge that we teach learners; hence IK is used to understand, strengthen, and explain scientific knowledge.*

It should be however noted that the Life Sciences CAPS is not meant to present the integration of IK as an addition to western knowledge, but rather as an opportunity for IK to interact with Western knowledge. In the process of integration, the two knowledge systems are reconciled and mediated. The teacher's idea of the integration of IK implies the addition of IK to science knowledge is therefore somewhat contrary to the policy documents.

4.3. Theme 3: The teachers viewed IK integration as a way of fostering empowerment and justice

The teachers viewed integration of IK as a way of fostering empowerment and justice to the marginalised communities who strive to utilise their own community heritage to solve own problems and develop their families and communities. The teachers perceive the integrating of IK into Life Sciences to

encourage diversity in the knowledge learned at school and empower learners to explore IK in formal schooling. This view is captured in the following quotations of the teachers:

Mr Zulu: *IK integration recognises the richness of indigenous knowledge systems and their contribution to transforming the learners' thinking and instilling pride in the learners as Africans for instance.*

Ms Mahlangu: *We are given the opportunity to teach science as a subject and to look at our own beliefs and try to compare the two knowledge domains. This encourages us Africans not to look down upon our beliefs.*

The teachers are of the opinion that when learners learn about their own IK in formal schooling, they become more confident in exploring and valuing their own traditional ways of doing things including. The findings revealed that it is important to integrate IK in the Life Sciences teaching and learning because learners need to know where they come from. They should be able to know their roots before they are able to know where they are going. Their traditional knowledge is important for their future. The findings indicate that learners will appreciate Life Sciences content if it is linked to their cultural heritage. On the other hand Mrs Welman thought that IK integration is important though there are issues that impede the implementation.

Mrs Welman: IK integration brought fear to us as teachers because we do not know how to approach it as we were never trained about it. Some teachers attempt to do it whilst others brush it off.

Mr Naidoo: IK integration helps to make learners aware of the scientific methods and ideas that were used in the past and that they do not differ from the ones they learn in class. The aim here should however not be misconstrued as aligning our science to Western science.

The same sentiments were shared by Mr Zulu who pointed that learners should relate experiences from home with those acquired at schools e.g. baking bread and brewing traditional beer and alcohol from Amarula plants as scientific processes.

5. Discussion

What emerged from the findings is that the participant teachers understood IK as beneficial to the teaching and learning of Life Sciences as it makes learners understand concepts and develop interest in the subject and at the same time assisting teachers to identify misconceptions learners bring to the science classrooms. The teachers' positive attitudes towards IK integration contradict the picture painted in previous studies (e.g., Dziva, 2012; Mothwa; 2012; Shizha, 2007) where teachers held a negative attitude towards IK INTEGRATION.

Teachers understood the benefits of IK integration in Life Sciences classrooms. These views resonate with the observations made by Aikenhead (1996) and Le Grange (2007) that IK integration enables learners to establish the link between school science and their everyday life experiences. There were, however, varied conceptualisations amongst teachers which could be attributed to their diverse sociocultural backgrounds.

Teachers observed the integration of indigenous knowledge in the teaching and learning of biodiversity of plants and related concepts as a means to promote equality, diversity and social justice in the knowledge taught in formal education. This notion is in accordance with De Beer and Whitlock (2009) and Ng'asike (2019) who explained integration of indigenous knowledge as a way of promoting transformation, social justice, and equality. The teachers perceive the integration of IK into Life Sciences as a way to encourage diversity in the knowledge learnt at school and empower learners to explore IK in formal schooling. This view supports that of Semali and Kincheloe (1999), where the authors mentioned the integration of IK as a means of addressing social inequalities and promoting equity.

6. Conclusion

From the findings, there are both negative and positive aspects from the way teachers understood IK integration in the Life Sciences classrooms. It should be noted that there is a misunderstanding that IK integration is an attempt at giving IK the same status as Western science. Neither should IK be viewed as an addition to an already established scientific knowledge. Such a stance tends to devalue IK and promotes the marginalisation that has been in existence. A point to note is IK has been there and utilised amongst its holders for a very long time hence in that context, it has been an established knowledge way before Western scientific knowledge. On the positive side is the teachers' understanding of IK integration as a way of restoring justice, embracing diversity, and equality amongst humanity. These findings have implications for both science teacher professional development and classroom practices. Teacher

educators and in-service teacher providers need to develop pre-service and in-service science teachers respectively not only on how to integrate IK in science classrooms, but also in transforming their views towards the status and role of IK in relation to Western science.

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