

## Perceptions of Chemical Engineering Students on Decolonizing the Curriculum by Incorporating Indigenous Knowledge Practices

**Machodi Mathaba**

ORCID:0000-0001-7046-890X

Chemical Engineering, University of  
Johannesburg, Johannesburg, South Africa

mmathaba@uj.ac.za

### ABSTRACT

The #FeesMustFall movement, which rocked institutions of higher learning in South Africa in 2015/2016, inspired robust engagement around the decolonization of knowledge. Students argued that the epistemological context of higher education in South Africa does not reflect the African context. Activists argued that if the curricula did not speak to local issues, the challenges facing higher education would remain. Incorporating indigenous knowledge practices into mainstream education could signify a shift away from Western dominance in the local episteme. Engineering is not immune to decolonization. This paper attempts to extract the views and observations of 38 chemical engineering students, from second year until PhD level, at the University of Johannesburg on decolonizing the curriculum by incorporating indigenous knowledge practices. The data was generated through an open-ended questionnaire. The questionnaire required that participants briefly describe indigenous practices with the potential for elucidating chemical engineering principles. Participants identified umfuso, which is the process of drying vegetables in the sun, sieving with leselo, which is made up of reeds and is used to separate light materials from heavy ones, drinking cow urine as a remedy to cure various diseases, making traditional mageu, brewing traditional beer (umqombothi) and milling and grinding maize meal, as practices which they believe had potential to reshape the curriculum. The findings of the study show that students concurred with the call for decolonization and transformation of the chemical engineering curriculum, but that there was a lack of consensus on whether incorporating indigenous knowledge practices could help achieve it, as the system of acquiring education itself needs decolonization.

Submitted: January 13, 2022

Accepted: July 20, 2023

## Introduction

Student activism against unaffordable and rising tertiary education fees, particularly amongst disadvantaged groups, is not something new in South African higher education. But earlier protests could not compare with the late-2015 and early-2016 #FeesMustFall campaign, which brought institutions of higher learning to a standstill (Essop, 2016). Apart from the social media influence during the campaign and involvement of students from both historically advantaged and disadvantaged backgrounds, the call by students for decolonization of educational systems and transformation of universities gave substance to the movement and gained public sympathy. Students argued that universities remain rooted in colonial, apartheid and Western epistemological cultures which rely largely on Eurocentric knowledge. Decolonization of knowledge is also not new in South Africa and although it is still not yet understood nor agreed upon, Mamdani (1999) notes that if an Africa-focused intelligentsia addressing Afrocentricity is not realised, the challenges facing South African universities will remain. There is a consensus that the current academic knowledge constituting the curriculum in South Africa emerges from a Eurocentric perspective and is informed by the lived experiences of Europeans. Therefore, reshaping local academic knowledge and incorporating African lived experiences can also find resonance in transforming universities. South African and African indigenous knowledge practices, to which most students can relate, might be used to inform local academic syllabi.

The engineering field is not immune to the decolonization agenda and since engineering is at the heart of national development plans and transformation, robust and intellectual engagements are needed within the engineering curriculum (Fomunyan, 2017). Most authors and activists argue that the fundamental challenge facing higher education in South Africa is lack of relevance (Shay, 2016). The lack of relevance in African societies is perpetuated by the fact that most educational structures in these societies are inherited from colonialism and are tied to their former colonisers (Kaya & Seleti, 2013). Therefore, in the context of engineering, engineering education must focus on what African engineers have thought of or done in the past. The fact that the current, Eurocentric engineering curriculum privileges or draws its inspiration from European challenges at the expense of local contexts suggests the need for a decolonized knowledge base.

Garuba (2015) further argues that higher education in South Africa is dominated by Western views and leaves no space for local experiences and indigenous practices. The costs of accessing this curriculum contribute to this challenge but Hanrahan et al. (2006) add that the fundamental

constraint is the exit level of the qualification in relation to employers' and professional/industry expectations. Despite the number of engineering graduates our universities produce, the current curriculum underprepares graduates to tackle local challenges. A decolonized engineering curriculum should speak to local needs and national development strategies on the African continent and the world in general without taking away the fundamental engineering principles embedded in the field (Shay, 2016). Incorporating African indigenous knowledge practices in the engineering curriculum could help reshape the thinking and approach to the field by students and address some of the challenges faced by communities, especially those still engaging in indigenous practices. It is against this background that this study aims to understand and articulate chemical engineering students' views and perceptions on incorporating indigenous knowledge practices into the chemical engineering curriculum.

### Literature review

Achille Mbembe, in his article "Decolonizing the university: New directions" (2016), argued that the goal of higher education is to inspire independent thinking amongst students for them to develop their own intellectual capacity and moral lives. The call for a decolonized higher education system symbolises dissatisfaction by the university populace towards the current Eurocentric episteme. Decolonization of knowledge refers to interrogating the thinking, framing and construction of what constitutes the curriculum. In the South African context, Heleta (2016) argues that it means tackling and dismantling Eurocentric epistemological hegemony and placing South Africa, Southern Africa and Africa at the centre of teaching, learning and research. This implies radical interrogation of the colonial epistemic hegemony and re-examination of the curriculum for improvement, retrieval and reclamation (Lwandle & Yallem, 2021).

Generally, one of the major hindrances to decolonization of curricula, as noted by Lwandle and Yallem (2021), is the epistemic environment. Although forces of opposition to change are still entrenched in university structures, a more evidence-based approach to dismantling the epistemic violence of Eurocentrism can give much-needed substance to the call for decolonization. Decolonization of curricula can serve as a powerful vehicle for change in achieving national economic, political and social development goals. Decolonizing higher education curricula can help address fundamental challenges facing society as colonial epistemologies sustain the conscious and unconscious bias towards Western ways of knowing (Paraskeva, 2013). The current colonial and apartheid curricula in higher education have always and continue to promote white supremacy and

dominance and are disconnected from African realities and the lived experiences of the black majority. In his book, “Decolonising the Mind: The Politics of Language in African Literature”, Ngugi wa Thiong’o argues that transformation requires looking at the curriculum in terms of its relevance to our situation. Although the objective of decolonization is centring African perspectives, another challenge to be noted is the understanding or definition of decolonization in different fields (Knight, 2018). Mkhize (2018) and Makhubele, Mabvurira and Matlakala (2018) note the slow pace of incorporating South African indigenous languages in teaching and learning and research as a challenge. A context-sensitive approach in engineering is fundamental in aiming for graduates with decolonized minds (Fomunyan, 2017). Incorporating indigenous languages and practices into the mainstream curriculum could foster decolonization and shape pro-decolonization curriculum policies.

In the international context, the term “indigenous knowledge practices” is broadly defined as knowledge which a specific group of people in a geographical area accumulates over generations. Indigenous beliefs and practices are connected to cultural traits which are transferred from one generation to another. They are deeply entrenched and embedded in local communities and form part of their everyday lifestyle. The fact that communities survived before colonization and modern civilization is evidence that ancient indigenous beliefs and practices constitute a source of important knowledge in Africa, America, Asia and Australia (Ngomane & Mulaudzi, 2012). After centuries of colonial rule in Africa, systems of knowledge production and consumption still reflect Western hegemony. Even after independence, with the establishment of new universities and research institutions in Africa, these remain dominated by the same Western hegemony (Zezeza 2005).

Even though the libraries of indigenous knowledge have started to grow, the involvement of local indigenous practices in shaping knowledge production and research is disappointing. As of 1992, the United Nations and Civil and Human Rights movements have recognized indigenous people and indigenous knowledge systems. Countries such as India, Brazil, Colombia, Mexico, Bolivia, Argentina and, more recently, South Africa, have issued policy documents to not only endorse the revival of previously marginalized indigenous people but also to protect their intellectual rights and encourage researchers and education systems to use indigenous knowledge systems to shape their core activities. Incorporating indigenous practices into educational and research institutions may be met with hostility, but the objective should be to position them locally and globally to form part of the common sources of knowledge. African indigenous knowledge finds its strength through tangible application and, although it is local, its research potential must be strengthened to gain global

attention and recognition (Loubser, 2005). Additionally, indigenous people in Africa and other sister communities around the world continue to provide contributions such as cultural diversity, knowledge on how to value, manage and utilize natural resources, how to cope with natural disasters and the damages these bring, and how to maintain optimum use of resources and sustain their equilibrium. Vandenberghe (2021) has remarked on the fact that decolonizing the engineering profession in Canada can contribute to the attraction and retention of minority groups to participate in reconciliation efforts and move to a space of inclusion. Decolonization of the engineering discipline has been absent, and this is evidenced by the significant absence of decolonization literature, particularly in the STEM fields (Shahjahan et al., 2022).

### Research design and methodology

This case study is focused on chemical engineering students at the University of Johannesburg (Vanderstoep and Johnston, 2009). The University of Johannesburg was born in 2005 out of the merger between the modified Rand Afrikaans University and the Technikon Witwatersrand and it is one of the 26 public universities in South Africa and is located in Johannesburg. Its vision is to be “an international University, anchored in Africa, dynamically shaping the future.” Second-year national diploma, B-Tech, master’s, and PhD students in the Department of Chemical Engineering were selected to participate in the study. The Department of Chemical Engineering falls under the Faculty of Engineering and the Built Environment (FEBE), which is home to five schools, 12 departments and two technology stations. First-year students were excluded because they have not undertaken the fundamental modules required for a better understanding of chemical engineering principles. First-year chemical engineering students undertake service modules such as Chemistry, Communications, and Physics, amongst others, in various service departments and only one module, Chemical Process Technology, in the Chemical Engineering Department. For this study, students were selected as they are the major stakeholders in the curriculum and, importantly, they are the ones who have been leading the call for decolonization. A qualitative case study research method was followed by circulating open-ended questionnaires using the university’s learning management system and email. The study received ethical approval from the University of Johannesburg ethics committee in FEBE.

The questionnaire had three basic questions:

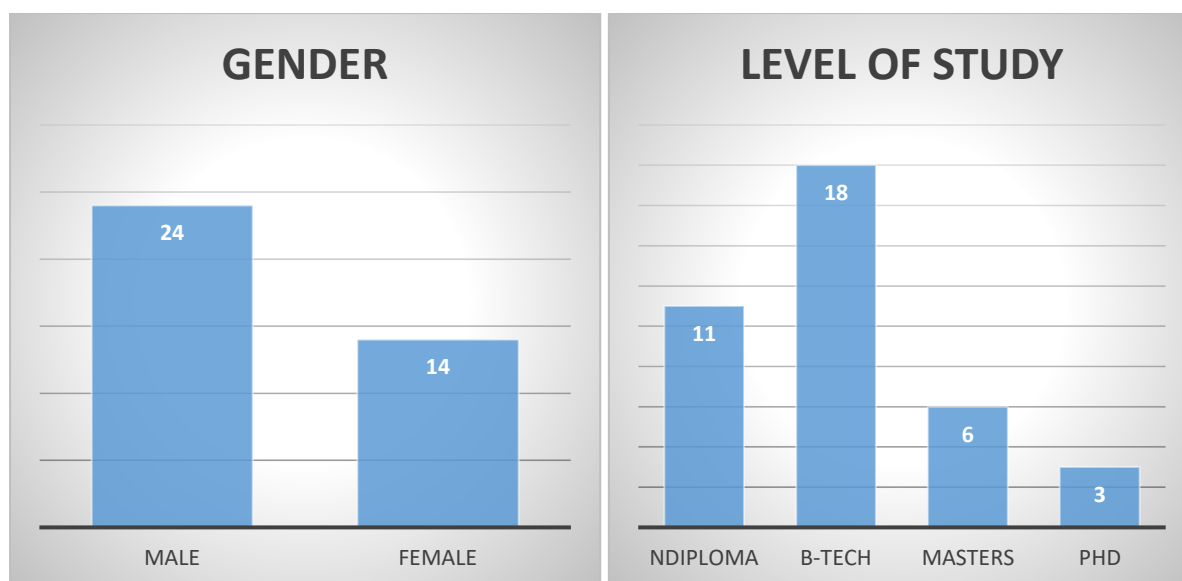
- 1) What do you think about the call for decolonization of knowledge?

2) Students, activists and some academics argues that incorporating African indigenous practices into the curriculum could constitute a decolonized curriculum. Will incorporating African indigenous practices help reshape chemical engineering curricula to be more decolonized?

3) Which African indigenous practices with chemical engineering principles do you know of that could be incorporated into the chemical engineering curriculum? Briefly explain how the practice is done.

### *Demographics of participants*

The target population was all full-time registered students in Chemical Engineering at the University of Johannesburg in 2017, except for first-year students. 42 completed questionnaires were collected, but four of these were excluded from the data analysis because they were not properly completed. Figure 1 and Table 1 illustrate the demographic composition of all 38 participants - out of a total of 185 registered full-time chemical engineering students at the University of Johannesburg - whose results were used in the study. There was a gender imbalance amongst the respondents with only 37% of the respondents being female. However, the data is a fair representation of the enrolled chemical engineering students at the University of Johannesburg at the time. Although 51% of the South African population comprises of females, the low female representation in engineering courses correlates with global higher education participation rates in the engineering field (Fletcher, Sharif & Haw, 2017). As per Statistics South Africa, the South African population is predominantly black and the 2016 UJ Annual Report showed that 83% of the student population was black, hence the high percentage of completed questionnaire was by those who had an African language as their first language. The age distribution was concentrated around 25 years of age, which is normal for students in higher education in South Africa. Although only 22% of registered students participated in the survey, the demographic composition of student participation provided enough data to meet the author's objective for the study.



**Figure 1.** Gender and level of study breakdown of participants

**Table 1.** Age and first language distribution of participants

AGE		FIRST LANGUAGE			
Range	%	Language	%	Language	%
18 – 21	21	English	5	Tsonga	5
21 – 25	34	Sepedi	18	Venda	11
25 – 30	34	Sesotho	13	Xhosa	8
30 – 35	8	Setswana	16	Zulu	16
35 and older	3	Siswati	5	others	3

## Findings

The study instrument used aimed at gaining insight into chemical engineering students' views on indigenous knowledge practices with potential chemical engineering principles embedded in them. The findings of the study indicate that students concur with the call for decolonization and transformation of the chemical engineering curriculum, but there was a lack of consensus on whether incorporating indigenous practices can help address this call. One participant argued that "I think it's a good idea to be explored as it will free human beings from uneducated mind as it brings everyone in the country to getting knowledge irrespective of background, culture, race or financial stability". One of the participants argued that "Communities in townships and rural areas have for decades been using ancient methods to survive and should be consulted when incorporating indigenous practices in the curriculum". In another study by Fomunyam (2017), it was observed that

although students agree that engineering education needs to be decolonized, there was general discomfort with the complexity and process of decolonizing it. Although the data collected focused on gaining insight into chemical engineering students' views on indigenous practices with chemical engineering principles, the observations made by some of the participants signalled a fear of breaking loose from the Western epistemologies under which they are being educated. One master's student said, "I support decolonization, but it should be done carefully so the chemical engineering field would not lose global relevance and significance"; while another student argued that "most of the Indigenous practices performed by the parents and grandparents at home, although they could not be fully explained or understood, they would achieve the desired outcome". A participant cited an example of "the drinking of cow urine to cure some diseases". The elders would not technically or scientifically elucidate which constituents of the urine cure the diseases, but because of experience and culture, they know it works. This opens opportunities for African emerging scholars and young intellectuals to embark on scientific evidence-backed fact-finding missions regarding these indigenous knowledge practices to give them resonance in mainstream education. Here, the participant recognizes the fact that, due to a lack of scientific evidence, indigenous knowledge practices find it difficult to gain global recognition and shape the curricula, although those practices have scientific principles embedded in them. Using the cow urine example, some scientific research suggests that it has chemotherapeutic properties (Randhawa & Sharma, 2015), and a plethora of other health benefits (Mahajan et al., 2020), but we are yet to see derived products in retail shops or forming part of curriculum content in the health sciences.

On the question of incorporating indigenous knowledge practices into the chemical engineering curriculum, one participant stated: "From black excellence point of view, it will help as we will now be able to have our own tested and approved traditional beer, however, it might cause a stir in the traditional embassy side as we will now be taking away the good given natural taste of traditional beer and incorporating it with the new science system". Here, the participant comprehends the significance of placing indigenous, traditional beer in the mainstream but is anxious about the preservation and protection of its natural taste once incorporated and mixed with scientific methods. Another participant on the same question argued:

The African Indigenous practices will not be incorporated in the curricular rather it will be a subject on its own to learn about Africa. If the African Indigenous practices are incorporated in chemical engineering, it will be a starting point of trying to decolonize knowledge, because the colonized system of and methods of acquiring knowledge remain. Decolonization of knowledge should start by changing the systems in place of acquiring knowledge, for example, the colonial system 'it is said that a child education is only at school. School education is merely reading textbooks and prepare for a test and exam by memorising and take a test or exam depending



on how true the student answered, he or she can be deemed competent. This system is absurd and unfair. We have different gifts and strengths so one type of learning and education is not good enough. These methods need to be considered when Africa insights practices are implemented.

Another interesting view, which was not a focus of this study but is worth exploring, was the concept of the internationalisation of the chemical engineering curriculum. One participant expressed anxiety about taking away the global status of chemical engineering should indigenous knowledge practices be incorporated. Similar views were held by participants in the study by Fomunyam (2017).

Another concern amongst the participants was the language of instruction (in this case English). Participants argued that if indigenous knowledge practices are to be incorporated, the language of instruction should recognize the fact that some names and methods would be better understood when expressed in indigenous languages. One Swazi participant made the example of “indigenous food such as ligusha, umbitfwo and tintsanga”. Similar observations were made by Fomunyam (2017). The language question and colonialism complement each other, and it is fundamental to recognize the significance of language in decolonization programs. Colonial states enforced indigenous communities to be indoctrinated with colonial thought processes and languages to believe that everything “white” is right. Malcom X described African Americans’ perceptions as follows: “they always project Africa in a negative light. In hating Africa and hating Africans, we ended up hating ourselves without even realising it”. The question of national languages gained additional recognition through Ngugi wa Thiongos controversial book, “Decolonising the Mind”.

While presenting their views on incorporating indigenous practices into chemical engineering to achieve decolonization, some participants opted to name practices which they believe contain scientific and engineering principles. They believe research should be carried out on those practices to uncover the scientific and engineering principles embedded in them. Below are some of the indigenous practices identified by participants and justification as to why they believe these indigenous practices contain scientific and engineering principles and should form part of the chemical engineering curriculum.

#### *Umfuso*

This refers to the drying and preservation of green food from the farms during cultivation season for future consumption when there is no more rain. In Sepedi, the dried and preserved green herb (morogo) product is called “mokhusha”. Bread can also be dried and stored for longer periods without expiring for consumption at a later stage. Currently, the practice is seen when there is

leftover bread after events (such as weddings, funerals, etc.) where it will be dried in the sun, sometimes buttered. The final product is now commonly known as toasted bread. Another food product obtained through “umfuso” is what in Sepedi is called “mogwapa” (biltong). The processing setup makes sure the food does not touch the ground by elevating it, using small wood pillars, to prevent biological decomposition and degradation by microorganisms. The food is placed on a net to prevent moisture formation which could cause decomposition.

#### *Grinding/milling of maize meal*

The practice of grinding maize after cultivation to produce mealie meal to cook hard or soft porridge is commonly used. The process is performed using two stones. The bigger, longer stone which is placed below and used to hold the material to be grinded is called “lwala” and a smaller stone, used to grind the maize by pressing the material against “lwala” and reciprocating (moving back and forth), is called “tshilo”. The bottom one is elevated a little bit to provide gravitational force when grinding is done. Technically, this process is commonly known as size reduction and sometimes referred to as comminution. The advantages of size reduction are that it leads to increased surface area, which, in the pharmaceutical industry, leads to an increase in the therapeutic effectiveness of drugs (Sud & Kamath, 2013) and increased liberation of desired valuable minerals in extractive metallurgy or mineral processing (Kelly & Spottiswood, 1982; Drzymala, 2007). The grinded/milled maize powder is collected at the edge. Unwanted particles in the final grinded mealie meal would be removed using “leselo” as detailed below.

#### *Separation using leselo*

This refers to a separating technique which takes advantage of the light density of unwanted materials which will be blown off by wind. The device used in the practice (leselo) is constructed from reeds joined together, with effective pore sizes which will allow certain materials to pass through and the lighter ones to be blown off by wind. The disadvantage of this indigenous technique is that the device’s performance depends on the person who constructed it as the pore sizes will differ. There is no consistency, however, with proper scientific investigations, scholars can devise means to optimize and improve its design to ensure consistent pore sizes and distribution. The advantages of this kind of process are that ensuring uniform particle size distribution leads to consistent processes and improved product quality.

### *Brewing traditional beer*

Traditional brewing is practiced by first grinding and milling maize meal using “lwala” and “tshilo”, and separating and screening with “leselo”, as already described above, and mixing the milled maize meal with lukewarm water. The mixture is then boiled before being cooled, mixed with yeast and left to ferment. The solids are subsequently separated and removed from the liquid through sieving. This drink has a very low alcohol content as the alcohol range is based solely on the natural fermentation of the mixture. In many African communities, homemade beer brewers use a similar procedure of fermentation, but it is not well monitored for quality, leading to a brew that can become contaminated and extremely harmful. Fermentation processes can be affected by several factors such as pH, the quality of water used, fermentation period and temperature. Scientific investigations during the brewing of traditional beer could help improve the process and could equally form part of the curriculum to teach students the scientific principles involved in the process.

### **Discussion**

A historian of religion, Chirevo Kwenda (2003), in his narratives and writings, advocates for cultural justice where members of each cultural group are not alienated from nation-building projects. That involves acknowledging that there is a creative centre in each culture and that only from within that centre can people really be influenced. This aligns with participants’ observations that, for decolonization of chemical engineering through incorporation of indigenous practices to be a success, communities should not be alienated since they utilize those indigenous processes. Indigenous practices relate to operationalised local thinking that has already claimed its credibility within communities, and with proven scientific evidence it can serve as a source of knowledge which can be applied in educational fields while improving lives in communities. The involvement of local communities as custodians of this knowledge and resourceful references is important and would help foster nation building and social cohesion.

Wa Thiong’o (2004) and Fanon (2008) argue that decolonizing the mind is the first step to decolonizing the entire system. It is very important for the colonized to understand the psychological effects of colonialism and undergo mental rediscovery. Hotep (2003) describes miseducation as a destructive effect on the black mind by schools which use a pedagogy and curriculum that deliberately omits, distorts, or trivializes the role of African people in and their seminal contributions to world history and culture. He further reasons that miseducation occurs in two ways: conceptual incarceration and learned indifference. Conceptual incarceration is black imprisonment in white

beliefs and knowledge bases which seek to perpetuate white superiority and intensify black inferiority. Learned indifference is a pervasive and self-destructive psychological disorder marked by disinterest in issues, causes and organizations that promote the political and socio-economic liberation of African people.

Africanizing and localizing engineering content by incorporating indigenous knowledge practices in the curriculum could be a start. In post-colonial Africa, we have seen the establishment of new universities and research institutions, sometimes by African intellectuals, but these institutions remain dominated by Western hegemony. These universities are in Africa, they teach and do research in Africa, but the methods and materials of what they teach and research do not reflect the African context. Mbembe (2016) argues that decolonization should be a project of rejecting the notion that the modern West is at the heart of Africa's consciousness and cultural heritage. Anwar Osman, during his inaugural lecture (Indigenous knowledge in Africa: Challenges and opportunities), argued that research and teaching of African indigenous practices are yet to be internalized but not without significant intellectual curiosity that is ready to disrupt and pose fundamental questions challenging the reluctance of the African academy to explore this source of knowledge, probing its potentials and studying its epistemology, assessing whether it can provide a complementary source of knowledge in a diverse and multi-cultural African society.

Although the focus of the study was not on the methods of teaching, one participant makes interesting observations worth considering. The participant argues that the entire method of acquiring knowledge needs revamping because it disadvantages students who might have talents and gifts other than reading a textbook and other study materials and reproducing content in a test or exam. In the book "An Analysis of the #FeesMustFall Movement in South African Universities", edited by Malose Langa, one of the interviewees at the Cape Peninsula University of Technology alleged that "the university just doesn't give the students enough support and encouragement and those that come from rural areas shows incredible potential but due to the nature of the system, that potential isn't developed" 2017:18. Additionally, the participant alleges that merely incorporating African indigenous knowledge practices into the chemical engineering curriculum would not decolonize the system, although it would be a starting point, as the colonial method of teaching would remain. This view is supported by Heleta (2016: 6), who agrees that "if universities and academics want to genuinely contribute to socio-economic transformation in the country and on the African continent, they must profoundly change what they teach and how they do it". This anxiety is caused by what Osman alludes to when he states, "epistemology or knowledge of the

indigenous largely rests on the spiritual and mental perceptions without necessarily having proven that empirically” (2010: 5). It is unfortunate that most universities and research institutions still regard the African Indigenous Knowledge System (AIKS) as “other” and, equally, that there is not much commitment and/or enthusiasm by academics to do research in the field due to lack of governmental and financial support. Osman further argues that “the scene is set up and conditions are conducive more than any time before for African scholars and young researchers to start unpacking the AIKS and work systematically and simultaneously on two research fronts; one that focuses on positioning the AIKS as a source of factual knowledge and the other on AIKS as a source of solutions to contemporary socioeconomic and environmental issues” (2010: 8). The international educational arena will start recognizing and appreciating the AIKS as a source of knowledge once Africans themselves take it seriously and sell it in global spaces. He argues that colonial languages spoken in various parts of the world by colonized communities constitute how the world should be understood and apprehended and that the drive to replace colonial cultures with national ones will safeguard national cultures and sovereignty.

## Conclusion

This article attempted to extract the views and perceptions of chemical engineering students at the University of Johannesburg regarding the decolonization of chemical engineering by incorporating indigenous practices into the curriculum. The participants showed overwhelming appreciation of the need for decolonization. However, there was discomfort on whether incorporating indigenous practices would achieve the desired objective. There was also fear that this reconfiguration might take away the global competitiveness of graduates. Although many of the participants lacked understanding or knowledge of indigenous practices with potential chemical engineering principles, a few were able to identify practices which are worth investigating further. Even though the participants opted not to describe how the practices are performed step by step in detail, the brewing of traditional beer was mentioned as the sequential processes involved, from size reduction by grinding and milling (using *lwala* and *tshilo*), separation and screening (using *leselo*), to the fermentation process, do have scientific and engineering principles embedded within them. It was also argued that if indigenous practices were to be incorporated into the mainstream curriculum, the language of instruction needs to be considered since some of the indigenous names would be better understood if expressed in indigenous languages. It was additionally pointed out that incorporating indigenous practices in the curriculum would not fully decolonize the system because the colonial status quo would remain. It was suggested that another angle of decolonizing the system should

look at the teaching and assessment criteria or processes. Decolonization of what is taught in institutions of higher learning is not without relevance to chemical engineering and urgent intellectual robust engagement is needed. The decolonizing process requires contextual relevance and curriculum change and incorporating indigenous practices for teaching and research purposes could be a start. It is a strategy to not only produce quality graduates but a mechanism to ensure that these graduates concentrate on local developmental challenges rather than being consumed by foreign examples to which they might not even relate. The aim would be to not take away significant engineering fundamentals and to ensure that graduates can still find resonance in global engineering.

### Acknowledgements

The author wishes to convey humble and sincere appreciation to the chemical engineering students who participated in this research, as well as the University of Johannesburg FEBE for granting ethics clearance to allow access to the students.

### References

- Drzymala, J. 2007. Mineral processing: Foundations of theory and practice of minerallurgy. <https://www.semanticscholar.org/paper/Mineral-processing-%3A-foundations-of-theory-and-of-Drzyma%C5%82a/30dca3f559ed03bf5e31073c49af4d49fdb1bc> (date of access??)
- Duncan, J. 2014. South African journalism and the Marikana massacre: a case study of an editorial failure. *The Political Economy of Communication*. 1(2).
- Essop, A. 2016. Fees must fall - but not at the expense of quality higher education. Available from <https://theconversation.com/fees-must-fall-but-not-at-the-expense-of-quality-higher-education-62520> The Conversation, Johannesburg. (Accessed: 05 November 2021).
- Fanon, F. 2008. *Black Skin, White Masks*. New York: Grove Press.
- Fletcher, A.J, Sharif, A.W.A. and Haw, M.D. 2017. Using the perceptions of chemical engineering students and graduates to develop employability skills. *Education for Chemical Engineers*. 18: 11-25. <http://dx.doi.org/10.1016/j.ece.2016.07.001>
- Fomunyam, K.G. 2017. Decolonising the engineering curriculum in a South African University of Technology. *International Journal of Applied Engineering Research*. 12(17): 6797-6805.
- Garuba, H. 2015. What is an African curriculum? *Mail & Guardian*, 17. <https://mg.co.za/article/2015-04-17-what-is-an-african-curriculum/> (Accessed 05 November 2021).
- Heleta, S. 2016. Decolonisation of higher education: dismantling epistemic violence and

Eurocentrism in South Africa. *Transformation in Higher Education*. 1(1):1-8.  
<https://doi.org/10.4102/the.v1i1.9>

Hanrahan, H.E., Beute, N., Fraser, D.M., Gosling, J., Lawless, A. and Jandrell, I.R. 2006. Engineering education in South Africa: in fragile good health, denial or crisis? In African Regional Conference on Engineering Education. University of Pretoria, 26&27 Sept.

Hotep, U. 2003. *Decolonizing the African mind: Further analysis and strategy*. Atlanta GA: Kwame Ture Youth Leadership Institute.

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

Kelly, E.G. and Spottiswood, D.J. 1982. *Introduction to Mineral Processing*. New York: Wiley.

Knight, J. 2018. Decolonizing and transforming the geography undergraduate curriculum in South Africa. *South African Geographical Journal= Suid-Afrikaanse Geografiese Tydskrif*. 100(3): 271-290.

Kwenda, C.V. 2003. Cultural justice: The pathway to reconciliation and social cohesion. In Chidester, D., Dexter, P. and Wilmot, J. *What holds utogether: Social cohesion in South Africa*. Cape Town: Maskew Miller. 67-80.

Langa, M., Ndelu, S., Edwin, Y. and Vilakazi, M., 2017. # Hashtag: An analysis of the # FeesMustFall movement at South African universities.

Loubser, J.A. 2005. Unpacking the expression "Indigenous Knowledge Systems". *Indilinga African Journal of Indigenous Knowledge Systems*. 4(1): 74-88.

Lwandle, N. and Yallem, A.T. 2021. Towards enablers of decolonisation of the curriculum in universities in South Africa. In Sosibo, Z.L. & Ivala, E.N. (eds.) *Creating Effective Teaching and Learning Spaces: Shaping Futures and Envisioning Unity in Diversity and Transformation*. Wilmington, Delaware: Vernon Press.

Mahajan, S.P., Chavan, S.A., Shinde, S.A. and Narkhede, M.B. 2020. Miraculous benefits of cow urine: A review. *Journal of Drug Delivery and Therapeutics*. 10(4-s): 275-281.

Makhubele, J.C., Mabvurira, V. and Matlakala, F., 2018. Exploring language as an impediment to or a resource for the indigenisation of social work education. *Southern African Journal of Social Work and Social Development*. 30(1): 1-20.

Mamdani, M. 1999. There can be no African Renaissance without an African focused intelligentsia. *Southern Africa Political & Economic Monthly*. 12(2): 51-54.

Mbembe, J-A. 2016. Decolonizing the university: new directions. *Arts and Humanities in Higher Education*. 15(1): 29-45. <https://doi.org/10.1177/1474022215618513>

Mkhize, D., 2018. The language question at a historically Afrikaans university: access and social justice issues. *Southern African Linguistics and Applied Language Studies*. 36(1): 13-24.

Osman, A. 2010. *Indigenous knowledge in Africa: Challenges and opportunities*. Inaugural Lecture, University of the Free State.

Paraskeva, J.M. 2013. *Conflicts in Curriculum Theory: Challenging Hegemonic Epistemologies*. New York City: Springer.

Randhawa, G.K. and Sharma, R. 2015. Chemotherapeutic potential of cow urine: a review. *Journal of Intercultural Ethnopharmacology*. 4(2):180.

Shahjahan, R.A., Estera, A.L., Surla, K.L. and Edwards, K.T. 2022. "Decolonizing" curriculum and pedagogy: a comparative review across disciplines and global higher education contexts. *Review of Educational Research*. 92(1): 73-113.

Shay, S. 2016. Decolonising the curriculum: it's time for a strategy. *The Conversation*. 13.

Sud, S. and Kamath, A. 2013. Methods of size reduction and factors affecting size reduction in pharmaceuticals. *International Research Journal of Pharmacy*. 4(8): 57-64.

Vandenberghe, J. 2021. How professional engineers can contribute to attraction and retention of minority groups into the engineering profession through equity, diversity, inclusion, and decolonization efforts. *The Canadian Journal of Chemical Engineering*. 99(10): 2116-2123.

VanderStoep, S.W. and Johnson, D.D. 2008. *Research methods for everyday life: Blending qualitative and quantitative approaches* (Vol. 32). Hoboken, New Jersey: John Wiley & Sons.

Wa Thiong'o, N. 2004. *Decolonizing the Mind. The Politics of Language in African Literature*. Nairobi, Kenya: East African Educational Publishers Ltd.

Zezeza, P.T. 2006. The disciplinary, interdisciplinary and global dimensions of African studies. *International Journal of African Renaissance Studies*. 1(2): 195-220.

<https://doi.org/10.1080/18186870608529717>



This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>