Decolonising the Engineering curriculum in a South African University of Technology

Dr Kehdinga G. Fomunyam

Durban University of Technology, Durban, 4001, South Africa.

Orcid ID: 0000-0003-2510-3498

Abstract

The coming to being of the 'MustFall' movements in South Africa heightened the call for decolonising the higher education sector. With engineering being at the heart of national development and transformation, there is greater need for engagements in the engineering curriculum to foster the debate on epistemological access and skills development. This paper therefore explores the challenges in the engineering sector in South Africa and highlights decolonising the curriculum as one way of addressing it. As such the research was designed as a qualitative case study and data was generated using open ended questionnaires. The data generated was coded and categorised and themes were developed from the categories which were used for analysis. The findings of the study reveal that four key areas required decolonisation; theory and practice, language, academics and pedagogy. It further revealed that teaching and learning within the institution failed to enhanced decolonisation. The findings further indicated that the decolonisation process can be enhanced by creating contextual relevance and curriculum change. The paper concludes by recommending that decolonising the engineering curriculum is long overdue and the powers that be need to take responsibility and engage the subject if the training of more engineers is the goal. Secondly, the language of instruction, pedagogy, teaching and learning process and or theory and practice requires further interrogation to enhance the training of young engineers for without this the engineering question or challenge will for ever be a mystery.

Keywords: Engineering, curriculum, South African higher education, students, decolonisation,

INTRODUCTION AND PROBLEM

Decolonising has recently become the new buzz word in South African higher education, where almost all stake holders are demanding for the decolonisation of the curriculum in particular and higher education institutions in general. While this is not surprising, it is however surprising that it has taken twenty years after the advent of democracy for this movement to surface. The higher education sector in South Africa has been focusing on transformation since the introduction of the Higher Education Act of 1997. South African universities have demonstrated different understandings of transformation and

have enacted the same in their institutions but this has brought little or no change in their institutions and the society at large, hence the cry for decolonisation. This cry for decolonisation took another turn when the statue of Cecil John Rhodes (a central figure in Apartheid South Africa) in the University of Cape Town located at the centre of the university was desecrated by a student. The cry was taken up by students from other universities including Rhodes University, where students called for the renaming of the university. Students at the University of KwaZulu-Natal covered a statue of King George V with white paint and students at University of Witwatersrand held transformation talks (Pather, 2015). The cry for decolonisation is a call by university stake holders for the end of white, western, or the global north's supremacy in South African higher education and the fostering of South African thought, African perspectives and experiences and indigenous epistemologies in the curriculum in particular and the higher education sector in general (Heleta, 2016). This takes decolonisation away from the political or traditional notion of decolonising which means the process of relinquishing control of a territory by the coloniser to the colonised, to the more rigorous intricacy of shedding away colonial legacies from the education system be it material or ideological.

Mgqwashu (2016) argues that academics in South African higher education institutions are trying to rid their universities of the procedures, processes, practices and beliefs which mark or articulate anything not white or European as inferior and decolonising the curriculum is part of the process. This means that dealing with or doing away with the colonial ideologies and epistemologies constitutes part of the decolonisation process. Decolonising the engineering curriculum is a move in this direction. Booker (1954) recognised the need for finding an alternative pathway for engineering based on contextual needs as far back as the fifties when he argued that "the principal function of undergraduate education should be to develop the mind of a student by having him think through things that other people (within his context) have frequently thought through before. It should be the object of undergraduate education to pursue this process to the point where it is no longer worth the student's while to think through well-known thoughts merely in order to develop his mind". Engineering education in Africa therefore should be focusing on what African engineers have thought of and done in particular and the world in general. This would provide the

basis for them to innovate on the needs of the African people as well as drive development on the basis of contextual reality rather international fallacies.

Shay (2016) argues that one of the greatest challenges facing higher education in South Africa is the lack of relevance in the undergraduate curriculum. The undergraduate curriculum beginning from the hard sciences and engineering to the social sciences is no longer fit for its purpose. This lack of relevance raises fundamental questions not about the appropriateness of the bachelor's curriculum in general and engineering in particular but also raises questions about the quality of engineers produced. The fitness for purpose can be questioned on two fronts; on the one hand, there has been expansion in the higher education sector for over two decades in South Africa which has resulted in improve access to higher education across race and class. This creates several problems especially in engineering because the current cohort of students don't fit the profile of the typical "mainstream" middle class, white, "university-ready" 18-year-old school leaver. On the other hand, the ever changing job market into which graduates are push into, has moved beyond the realm of stagnant job descriptions to ever changing roles which a stagnant curriculum is unfit to train for.

Shay (2015) posits that another challenge for engineering is professionalism especially because the world at large is grappling with the same. For example, should universities in the province of KwaZulu-Natal develop curricula in the field of engineering which speaks to local needs, and national development plans in particular and the African continent and the world in general or remain with the Eurocentric curriculum which privileges or tackles European challenges at the expense of contextual issues. The need to focus on South African in particular and African challenges in general has created the need for decolonisation (Heleta, 2016). Furthermore Shay (2015, p. 2) adds that focus on contextual problems raises other issues ''the balance and sequence of theory and practice, and the plurality of theories and methods required to solve the problems. Very few of today's "wicked" problems can be solved through one perspective or one method of investigation (the Eurocentric approach which has dominated the field of engineering)". Garuba (2015) adding to this argues that worldviews in the global north has dominated the higher education landscape in South Africa giving no room for the expression of local experiences and indigenous knowledge. This domination has been championed by ''white, male, western, capitalist, heterosexual, European worldviews''(Shay, 2015, p. 3). This means the curriculum content fails to represent or undervalues the experiences, perspectives and epistemologies of those who do not fall within this dominant class.

Shay (2016, p. 4) supported by (Fomunyam & Mnisi, 2017) adds that the engineering curriculum in particular and undergraduate curricula in general keeps ''reproducing inequalities and particularly its assessment systems – serve to reproduce society's broader inequalities. This challenge has received very little attention in the recent debates on "decolonising". It is the way in which the curriculum at every point – from who gets admitted, who thrives, who survives, who fails – mirrors back the historical and current unequal distribution of educational resources in the broader society''. The reproduction of inequalities and the production of engineers who are predominantly of a particular race constitutes part of the challenges facing engineering education and why it needs decolonising.

Hanrahan et al. (2006) adding to this argue that there is an undersupply of engineers in South Africa and the principal reason for this is the curriculum. They go further to provide a number of reasons for this. The first reason is that most students are unable to gain epistemological access into the curriculum. First generation students lack the social capital to access curriculum content raising the need for decolonisation. Secondly, curriculum design has a two-constraint problem; the one deals with the exit level of the qualification in relation to expectation of the employers and profession. Students are becoming more and more underprepared as they leave the university and this is becoming a challenge within the engineering sector. Also, the number of engineers produced by the higher education system has been low and this needs to increase. For this to happen, there is need for curriculum review with emphasis on skills and competences. Concurring with this, Greve (2013, p. 2) argues that a tangible number of engineering students tend to drop out of university within the first two years. By the fourth year, in certain fields as few as 10% of the original first year class graduate. She goes further to articulate that the study which saw over 700 engineers completing a survey indicated that ''43% of South African engineers believe that engineering qualifications currently on offer by tertiary institutions are inadequate''. This inadequacy can only be addressed by the decolonisation of the curriculum to foreground local experiences and epistemologies.

Mhilu, Ilemobade, and Olubambi (2008) further argue that the type of engineering curricula used in South African universities, and the review of such curricular has been observed to be a key challenge for engineering education. This review process they argue often consist of two approaches; the exclusion of relevant subject matter from the curriculum to ensure mastery of what is left, or the inclusion of more materials in the curriculum, forcing lecturers to dedicate less time to each section. This is confirmed by Patel (2017, p. 10) the spoke's person for the University of the Witwatersrand who citing Professor Ian Jandrell, dean of the faculty of engineering and the built environment at the University of the Witwatersrand argues that "South Africa runs the risk of being left behind and of being marginalised by the global community if we do not consider, as a national priority, the need to invest in universities in general, and engineering in particular," for "it is only universities that can replicate in great measure the high-level scarce skills to move our country forward and to foster development on the continent''. Decolonising the curriculum is

one way of addressing this challenge since it will not only ensure epistemological access, but also ensure proper training.

ECSA (2015) adds that of the 16 423 registered professional engineers in the country, almost 70percent of them were white. These figures which show that 13 794 were white, 1 496 black African, 967 Indians and 199 coloureds are the very reason why engineering needs decolonisation. Furthermore, of the 16423 professionals, only 713 were females while the rest were male. ECSA (2016) adds that in 2016, 504 new professional engineers were registered with 438 of them being male and 66 being female. Again of the 504, 277 were white, 158 African, 60 Indians and 9 coloureds. The racial disparity or imbalance indicate the untransformed nature of the discipline across the nation as well as the need for decolonisation. Also the registration of only 504 professional engineers in the country over a period of one year throw more light on the throughput rates and the need for changes within the curriculum to ensure better results. This paper argues that the only way to address these challenges is through the decolonisation of the curriculum. To take this discussion forward, it is vital to discuss the concept of decolonisation.

THE CONCEPT OF DECOLONISATION

The decolonisation project is not new in Africa or the world at large. Since the fifties and sixties several nations in Africa battle with the question of decolonising the higher education system, while the past decade has seen Canada and New Zealand struggle to decolonise. Kapoor (2007) argues that colonialism was not just the political occupation of one nation by another, but a formation of discourse. And this discourse, is the domination of the thought pattern of the people using ideological, cultural, and educational tools amongst others. Through this tools the people are incarcerated in particular worldviews. This is supported by Fanon (2008, p. 18) who argues that ''colonial relationships did not restrict themselves to appropriating the labour of colonized peoples but through the "burial of their local cultural originality, created people with an inferiority complex which rested in their souls". It therefore means that although a nation has gained independence and now rules itself, certain aspects of the society might still be colonised. Twenty years after the advent of democracy in South Africa, there are calls for decolonisation within the higher education sector. Kapoor (2007, p. 4) adds that ''the attempt to reshape the structures of knowledge and the active subjugation and devaluation of local knowledges meant that several branches of learning were touched by the colonial experience''. Calls for decolonisation therefore are not strange or unique to South African higher education, but have manifested itself in places like India, Canada, United States of America, the Caribbean amongst others (Loomba, 2005). At this point decolonising therefore is of upmost necessity paying particular attention to a people's academic, mental and psychological prowess. Who they are, where they come from and where they are going to is to be showcased.

Tamburro (2013) argues that decolonisation is about creating awareness on the effects of colonization and destabilising the oppressive consequences of colonialism. Tamburro argues that any approach to education that includes the perspectives of Indigenous, non-Western people and their worldviews will help articulate local experiences and decolonise the process of knowing. This indigenous approach to learning will foreground the histories and current issues caused by colonization, and the need for self-determination, and governance using indigenous worldviews. Garuba (2015) discussing the decolonisation of Kenyan higher education in the 1960s, argues that certain fundamental questions which focused on place, perspective and orientation needed to be addressed before engaging in the reconceptualisation of the education system. By answering these questions, Kenya, East Africa and Africa was placed or to be placed at the core of teaching and learning, research in universities.

Ngugi (2004, p. 87) argues that decolonising education or higher education in Africa is about Africans seeing themselves ''clearly in relationship with themselves and others in the universe''. Ngugi calls this 'a quest for relevance'. This relevance can only be established if African universities succeed in decolonising the mind. This is because colonisation manifested itself in two forms; the exploitation of land and resources of the colonised, effecting fundamental changes in the modes of production to ensure the subjugation of the colonised and the worst of them all cultural domination established through education, religion, and other cultural forms. As such colonisation in most cases produced mutated citizens who believed in the values and highhandedness of their masters. Kaya and Seleti (2013, p. 33) supporting this argue that a decolonised higher education system must discard ''utilisation of dominant Western worldview of knowing and knowledge production''. The discarding of such hegemonic approaches to learning and knowing in African …would destroy the image of the global north or white both foreign and local as the all-knowing and all-important custodian of human knowledge, especially because it is through such that white/Western domination is maintained. As both Mbembe (2016) and Ngugi (2004) point out, decolonisation is not simply about eradicating European and introducing African, but about making Africa the centre in African universities.

Laenui (2011) enhanced by Chilisa (2012) articulate several stage for decolonisation; rediscovery and recovery, mourning, dreaming, commitment and action. Rediscovery and recovery sets the pace for eventual decolonisation and it involves the rediscovery of one's self, history, culture, language, and identity. Coming to a full understanding of who one is and what one have lost is the first step to decolonising. Rediscovery and recovery of what has been lost naturally leads to the second stage of mourning, where the colonised lament on their victimisation. Mourning is vital for decolonisation, and it can be expressed in different forms. Expressing the pain of what has been lost creates the need or desire for change and this leads to the third stage of decolonisation which is dreaming.

Dreaming is the most fundamental stage of decolonisation. It is at this stage that the colonised plan, debate, consult and build dreams about their future or a new social order. This stage offers the opportunity of exploring ones culture, identity, language and envisaging its return to the core of education. But it is vital to ensure that this process runs as long as necessary to ensure that an appropriate picture of the future is developed. This is vital because true decolonisation is more than replacing the colonial with the indigenous. It's about the re-evaluation of the political, social, economic, educational and judicial structures and the development of new structures if need be which can house the values of the colonised. Once a vision has been established, the next stage is commitment which entails committing to see this vision manifest. This stage gives rise to a single direction for the society as all stakeholders buy into or commit themselves to this vision. This paper is an attempt to articulate what needs to be decolonised in engineering education, how this should be decolonised, what can enhance the decolonisation process and the implications for decolonisation. To answer all these questions, it is of outmost importance to discuss how the data was generated and this is discussed in the next section titled research design and methodology.

RESEARCH DESIGN AND METHODOLOGY

This research was framed as a qualitative case study to enable the researcher generate in-depth data about the phenomenon. Qualitative research according to Vanderstoep and Johnston (2009) refers to research that probes into an individual's understanding and interpretation of his or her experiences with the aim of grasping the depth in every participant's story, while case study according to Neuman (2006, p. 40) is ''an in-depth study of one particular case in which the case may be a person, a university, or group of universities, an organization, a community, an event, a movement, or geographical unit''.

This study is a case study of a South African university of technology. This institution was chosen as a case study to enable the researcher generate rich and in-depth data on the decolonisation of the engineering curriculum. Cohen, Manion, and Morrison (2011) argue that case study is often used within qualitative research and the qualitative approach to research aims at exploring every detail about an issue or a case. It brings out the quality of whatever is being researched (Nieuwenhuis, 2010).

In order to generate data, this study employed open-ended questionnaires. About 500 questionnaires were circulated within the discipline of engineering to both students and lecturers but only 116 completed and returned the questionnaires. Amongst the 116, 6 were lecturers and 110 were students. Furthermore, of the 110 students 19 were 1st years, 30 were 2nd years, 31 were 3rd years, 21 were 4th years and 9 were postgraduate students. The students ranged from first year undergraduate to final year PhD students and these

students were from a plethora of disciplines within the field of engineering. Sixty-eight of them were male while forty-two were female. The questionnaire had five basic questions; 1) what do you think requires decolonizing in engineering? 2) Do you think teaching and learning in your discipline enhances decolonisation? 3) How can the decolonisation process be enhances? 4) What do you think can be done differently in your discipline to ensure decolonisation? 5) What are the implications of decolonizing the engineering education? The findings are presented and discussed on the basis of the questions.

Findings

The data generated was categorised into different units and from the units themes were developed which echoed the overall message of responses. From the first question on what requires decolonizing in the engineering curriculum, four themes emerged; theory and practice, language, academics and pedagogy. The second question which centred on whether or not teaching and learning enhanced decolonisation and why; 70 percent (81) of the participants said no, while 30 percent (35) said yes. The reasons for their answer where categorized into four themes; theory and practice, language, academics and pedagogy. The third question was focused on how to enhance the decolonisation process and from the data three themes emerged; contextual relevance, academics, and curriculum change. The last but one question, demanded the participants to identify certain things in their department which they think should change if the decolonisation process must move forward and three themes also emerged from this theme; partnership, social justice and language. The last question centred on the implication of decolonizing the curriculum and the data generated can be presented using four themes; mobility of labour, quality, contextual development, and unknown. These themes are discussed in the subsequent paragraphs in line with the questions from which they were developed.

The themes that emerged from the first question were; theory and practice, language, academics and pedagogy. Theory and practice is the centre of any field of study and how this is mixed up in the curriculum determines how successful the students will be. According to the participants of the study, theory and practice required decolonising in the engineering curriculum. To support this, one of the participants pointed out that ''the engineering program should decolonize the theory and focus on more practical and calculations. They should decrease the theory and put calculation''. According to this study, there was no balance between the theoretical aspect and the practical. Creating a balance would constitute decolonisation. Another participant supported this by adding that ''the projects and modules we do are biased and Eurocentric. As female students, it is kind of unfair for us to be forced to do projects with machines we cannot carry because the theory or textbook says so. Theory and practice should decolonised to help us succeed''. The second theme emerging in this question was language. The participants were of the opinion that the

language of instruction requires decolonisation. Focusing on this, one of the participants pointed out that ''engineering is difficult because lecturers teach in English. I think if the program can be taught in our home language, it will be easy to understand and it will also increase the number of people who want to take the career''. Another participant added that "in the field of engineering I think the thing of English must stop because other students fail because of this hard language that is used in engineering". The language of instruction is therefore foreign to the students and require decolonisation. The third theme which emerged was academics. The participants believe that the kind of academics or lecturers employed to teach in engineering need to change. Commenting on this, one of the participants pointed out that "most lecturers are trained or qualified in their countries and then come to SA (South Africa) to change the structure of the Engineering programme. This should stop. South Africans should be employed to teach us". Another participant added that there is need for "improvement and increase of native black South African lecturers in quality and numbers". As such the composition of lecturers need to be decolonised. The final theme which emerged from question one was pedagogy. To the participants, the approach used in conveying the curriculum required decolonising. One of the participants stated that "pedagogy is key. Approaches like Work Integrated Learning should be used to ensure we can fit in the corporate. The qualification is based on solving the challenges of our continent but the way we are taught makes use lacks skills and entrepreneurial abilities". To the participants of the study, theory and practice, language, academics and pedagogy were the four major areas that requires decolonising in the engineering curriculum and/or program.

In responding to the second question, 81 of the 116 participants said teaching and learning did not contribute to the decolonisation process in engineering while 35 of the participants said it did. In justifying their answer three themes (theory and practice, language and pedagogy) emerged from those who said no and one theme (academics) from those who said yes. Justifying their opinion that teaching and learning fails to enhance decolonisation the participants pointed out that teaching and learning was more about theory than practices. To this effect, one of the participants stated that "teaching and learning is still the same as before and there is no one assigned to make sure that students get in-service training in order for them to graduate since its still part of studying". To other participants, the language of teaching and learning was still a challenge as such it did not enhance the decolonisation process. Emphasising this, one of the participants stated that "the books (prescribed) used by lecturers are foreign. The teaching is done in English whilst there is no program in place which looks into students' communication difficulties". Another participant supported this by adding that "lectures are still done in English and we are forced to learn in English". This was further supported by another participant who stated that "the complicated language is used…try to translate English to

indigenous language". Furthermore, the participants pointed out that the pedagogical approaches used in teaching and learning was problematic, as such could not enhance teaching and learning. In line with this, one of the participants stated that "the way questions are set is funny. We can't understand it". Another added that "it is still continuing using the colonized methods and applications". Further emphasising on this another participant stated that "the pedagogy used in physics, electricity and communication transverse is still that of the colonizers". According to the participants therefore, doing away with such pedagogical practices in teaching and learning would enhance the decolonisation process. On the other hand, those who pointed out that teaching and learning enhanced the decolonisation project argued that the quality of academics used and the diversity took the decolonisation project a step further. Supporting this, one of the participants stated that "lecturers are from different races and gender and therefore helping students be able to feel comfortable and not like they are in a whole new planet in their own classrooms". Another added that "I have supporting lecturers who motivate students and also explain how their modules are related to the industries which brings more interest in learning or continuing with your engineering career". The composition of the academics involved in teaching and learning enhanced the decolonisation project.

In relation to the third question, students pointed out several ways through which the decolonisation process can be enhanced. And this were contextual relevance, academics, and curriculum change. Some of the participants of the study believed that for the decolonisation process to be enhanced, the curriculum needs to be contextually relevant. This according to one of the participants should be done by "relating African things to the things we learn rather than being taught by things that a white man discovered and what they can understand better". Another participant added that it can be enhanced by "using a program and curriculum that identifies South African and African problems and enhances South African creativity. A standard that is South African and not European, although it needs to be recognized internationally". Other participants thought that the academics working in the higher education sector or employed in the sector could be used to enhance the decolonisation process. One of the participants pointed out that "all people who don't belong to SA must be made to leave" and another participant added that this can be done "by appointing Chancellors and Faculty Deans who understand what it is like to have unemployed graduates wondering the streets with despair". Another participant further added that "more lecturers from SA should be given a chance". The race, experiences and social capital of those teaching within the institution according to the participants of the study would go a long way to enhance the decolonisation process. To some of the participants, curriculum change could be used to enhance the decolonisation process. One of the participants pointed out that there is a need for "changing the syllabus" and another participant added that "the curriculum being taught in the engineering program is all

about white people and all the things they do. It has little or nothing to do with Africa, our challenges or the things we need. We need to change the curriculum". There are several ways or things which can be engaged to enhance the decolonisation process.

The fourth question on the other hand centred on what could be done differently in the department to ensure decolonisation. To some of the participants the partnerships between the university and the industry could be used to ensure decolonisation. To this end, one of the participants stated that "by inviting companies to come and update us or work with us. In fact, to come and introduce us in the industrial environment so that as students we can get as much information as possible before it's too late". Another participant maintained that "the university must partner with companies and businesses so that we can learn what they are doing and practice or get experience before graduating. Without this partnership we would only be learning about what is happening in America or Europe which we see in textbooks". To other participants, to ensure decolonisation was all about engaging issues of social justice. One of the participants articulated that the curriculum must ensure "practice of humanity and self-respect to yourself and others'' and another participant opined that "European or foreign curriculum doesn't consider who were are, our cultures or believes or things like Ubuntu. The department needs to look at social justice issues to ensure that we are not only engineers but African engineers". Other participants on the other hand thought that language was the principal issue.one of them posited that the department must "introduce different language classes as optional modules". Changing the language of instruction appears to be of paramount importance to the participants of the study. Another participant added that "we don't understand the language the use in teaching us. The first step towards decolonisation is doing away with English and employing our local language". The engineering program or department need to do certain things differently to ensure decolonisation.

The last question seek to ascertain the implications of decolonising engineering education and to the participants, the implications were numerous. To some of the participants, it will affect mobility of labour since most graduates would simply possess contextual knowledge which cannot be used elsewhere in the globe. Supporting, one of the participants pointed out that "why would anyone want to do this? Engineering and Science is a field of study which is a universally agreed upon set of rules. Decolonizing it would be a waste of time and make it much more difficult for people to leave this country and work elsewhere. It is retarded, things like this that makes me want to get the hell out of this shit hole". Another participant added that "we could be banned from working overseas due to the change or it will be difficult to find work oversee". However the implications were not only about mobility of labour. To other participants, it was about quality and justifying this, one of the participants pointed out that "it will reduce the quality of education through misinterpretation". To other participants,

decolonising would lead to contextual development since engineers would now focus on local problems and finding solutions to them. Supporting this, one of the participants pointed out that "our engineers would be trained to focus on South African problems and not leaving to work in Europe and America. This would lead to the development of SA and the development of black industrialist". Development at the local or contextual level can be improved through decolonisation according to the participants. Another participant added that "South African students would get the chance to learn about and develop Africa and not focus on Europe or the dead white people we read about in text books". On the other hand some of the participants believed that the actual implications of decolonising are unknown. Over ten participants pointed out that they don't know what the implications of decolonising might be. One of the participants pointed out that "decolonisation is something we think or know we have to do, but the implications are what we are yet to know or what we will find out as we decolonise". To the participants therefore, the implications of decolonising are numerous depending on what lens one is using or what reason one has for decolonising.

DISCUSSION OF FINDINGS

The findings of the study indicate that engineering education requires decolonisation but the complexity of what needs to be decolonised and the process of decolonising are complex questions at the heart of this discussion. Tuck and Yang (2012) argue that the meaning of decolonisation in education in general and engineering education in particular has a variety of connotations. This is supported by Kapoor (2009) who argues that the ills of colonialism are far reaching and many societal stakeholders have failed to recognise this which has led to a continuous subjugation of the indigenous people. As such there is need for decolonising at different levels and on different fronts, and in the engineering program, this spans a range of issues. Fanon (2007) argues that decolonizing the mind is the first step, to decolonising the entire system and engineering education in this case is where to begin since it is at this level that students develop critical consciousness about life's realities, what needs to be changed and what should be maintained. Fanon (2007) and Tuck and Yang (2012) add that decolonizing in higher education centres on the cultivation of critical consciousness, to allow conscientisation which will help people in learning to see settler colonialism, to articulate critiques of settler epistemology, and set aside settler histories and values in search of ethics that reject domination and exploitation. Decolonising engineering education is therefore vital in the decolonisation of all facets of the society and the first step towards this is establishing a common understanding of what current and future engineers think. The participants of the study demonstrated different levels of awareness or understanding of what needs to be decolonised, how teaching and learning contributes or fails to contribute to the decolonisation process, what can be done to enhance the

decolonisation process and the possible implications of decolonising. While there is a general consensus amongst a majority of the students that there is a need for decolonisation, there is a lack of consensus on what areas of engineering education needs decolonising. However, there is a general consensus as far as all the participants of the study were consent that language is a problem. The language of instruction or English appears to be a problem to almost all the participants of the study. Since decolonising according to Fanon is about freeing or engaging the mind with a different set of knowledge paradigms, believe systems, experiences and social capital, language becomes the vehicle for this and to the participants, without a change in the language of instruction decolonisation would be incomplete.

Ngugi (2004) argues that knowledge is embedded in language and culture and culture itself to a certain level only expresses itself through language therefore for the African mind to be truly decolonised, the language of engagement or instruction needs to change. It line with this, Ngugi moved forward to write in Gikuyu a local language in Kenya. From the findings of the study therefore the language of instruction in engineering education is an issue to consider if the decolonisation process must advance. Fanon (2008) positions decolonization as chaotic, and unclean process or break from a colonial condition that is already over determined by the violence of the colonizer. Regaining independence at the intellectual level on the platform of chaos would be to tear it hegemonic principles, ways of thinking and language of expression. Ngugi (2004) adds that marginalised cultures and languages have the duty and responsibility of making themselves not only visible in their languages but also to challenge and shake up that view of languages in theory and practice especially since language is the basis for sustainable development.

Another set of participants saw decolonising the higher education system in the light of man power transformation or academics. Since the advent of democracy in 1994, there have been general debates in South Africa about transformation (Fomunyam, 2016; Fomunyam & Rahming, 2017). These ongoing debates have exposed several issues in the South African higher education sector such as racism, access, funding, throughput, and quality amongst others. Understanding decolonisation as the transformation of the higher education system in terms of lecturer composition becomes vital since these issues emanated during the era of apartheid. McGregor (2012) argues that decolonisation is working to advance the interests of indigenous people by transforming what shapes the society, in this case academics. This view of decolonisation in the light of transformation is further supported by Heleta (2016, p. 6) who argues that ''if universities and academics want to genuinely contribute to socio-economic transformation in the country and on the African continent, they have to profoundly change what they teach and how they do it''. If decolonising leads to transformation, then to decolonise in this case would be to change the academic composition within the university.

McGregor (2012) further adds that decolonisation is the transformation of consciousness through interactions between lecturers and students and the knowledge they produce.

Eradicating colonial mentalities or Eurocentric views about Africa in general and South Africa in particular and the way Africa should be seen is vital for the growth of the higher education system. Regan (2010, p. 189) argues that ''decolonization is not "integration" or the token inclusion of indigenous ceremony. Rather, it involves a paradigm shift from a culture of denial to the making of space for indigenous political philosophies and knowledge systems as they resurge, thereby shifting cultural perceptions and power relations in real ways''. To this effect, this should be the core of teaching and learning since African experiences constitute the core of local knowledge. This is further supported by Castagno and Brayboy (2008, p. 948) who argue that ''context matters; local contextual clues offer insights to connecting children to their schooling, and academic success follows''. The incongruities in teaching and learning brought about by the inability of the education system to address local challenges makes the case for the eradication of Eurocentric views and foreground contextual realities and philosophies which articulate local reality.

Heleta (2016) argues that South African higher education is dominated by Western epistemological traditions, histories and figures, and students are demanding for the end of the same. She adds that students are calling for the ''end of domination by 'white, male, Western, capitalist, heterosexual, European worldviews in South African higher education and the incorporation of other South African, African and global 'perspectives, experiences and epistemologies' as the central tenets of the curriculum, teaching, learning and research in the country (1). To deal with such level of crisis effectively, there is need for change in curriculum, pedagogy and language. This change should therefore bring with it social justice because decolonisation would be incomplete without social justice. This will help produce engineers who are not only African by birth but Africans epistemologically. Discussing the ills of a western education system in Africa, Mazrui (1978, p. 16) argues that ''western education in African conditions was a process of psychological de-ruralisation. The educated African became a misfit in his own village … when he graduated … his parents did not expect him to continue living with them, tending the cattle or cultivating the land''. Ensuring contextual relevance especially in engineering education in South Africa is of utmost importance because the role of engineers in the development of the society cannot be over emphasized. Adding to this Bray, Clarke, and Stephens (1998, p. 265) argue that ''the effect of the Western type of education has been to produce … three nations in one country, each unable to communicate effectively with the others … the 'educated,' … many who do not understand the ways of the 'educated,' … then … a third group, the 'half educated' who understand neither the ways of their own indigenous society nor those of the 'highly educated'''. Attempts at transforming such a complex system designed to

make South Africans misfits have failed, as such it's time to redesign the higher education system.

Chilisa (2012) argue that decolonisation involves five steps; rediscovery and recovery, mourning, dreaming, commitment and action. And the implications of this process are far reaching from mobility of labour, quality, contextual development, and unknown. Decolonising the engineering curriculum would offer opportunities to rediscover and recover, while teaching and learning would create room for mourning. Decolonising academics would create room for dreaming, while language and pedagogy would offer a platform for commitment. Sithole (2016) argues that the ontology of black subjects is what needs to exist since subjection does not allow such existence, and as such, it needs to be asserted. This means that decolonising is the responsibility of the subjected and the implications of this is far reaching. It is the responsibility of black subjects to emerge, and in so doing, the concerted effort should be made to resist subjection. Agathangelou (2016) adds that decolonisation as a revolution is a rupturing practice and is not a panacea and could itself lead to inertia, confusion and chaos. To this end, decolonisation might affect mobility of labour, quality, and contextual development. However its implications cannot be limited to this few but transcends barriers which cannot be anticipated before it happens.

CONCLUSION

This article which engages the decolonisation of the engineering curriculum attempts to explain a complex problem (the lack of engineers in South Africa), whose consequences are far reaching. Decolonization equals progress and improved educational experience in the training of engineers in the higher education sector. Decolonization is supposed to result in both student and society development since higher education is the gateway for social transformation. To this end, this paper concludes with four key points. Decolonising the engineering curriculum is long overdue and the powers that be need to take responsibility and engage the subject if the training of more engineers is the goal. Secondly, the language of instruction, pedagogy, teaching and learning process and or theory and practice requires further interrogation to enhance the training of young engineers for without this the engineering question or challenge will for ever be a mystery. Thirdly, since decolonisation is a complex process requiring resources and commitment, the university management must take vital steps to ensure that whatever happens in the higher education sphere in general and the in engineer program in particular is in line with the decolonisation needs of the program.

Lastly, the implications of decolonising the engineering curriculum are far reaching and the nature of these implications might never be fully known until the process is complete. However, it is certain that the program would be strengthened and improved as the decolonisation process unfolds. It might unveil difficulties associated with alternative programs in the discipline of engineering as a whole within the nation and help unmask how modern governments employ elitist nationalism or approaches to maintain the statusquo thereby quenching local interests and increasing desire for mobility.

Decolonising the engineering curriculum therefore is of vital importance not only to the engineering program but also to the students studying within this program and the nation as a whole whose future and development is dependent upon these engineers. Decolonisation is therefore a strategy not only to improve the number of engineers produced in the country but also as a tool or mechanism to ensure that these engineers focus on local problems and the development of the local as oppose to being swept away by global issues and the dictates of the global village.

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