

**Africanising soil science: a constructivist grounded theory for advancing
curriculum transformation**

by

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PREFACE

In prefacing this thesis, it should be noted that this work, while conforming to the linear prescripts of a doctoral study, does involve an intentional degree of cyclic reflection and progression in the development of its argument. The constructivist grounded theory produced in this study, mirrors and justifies such an approach in deepening understandings of Africanising a soil science curriculum.

Furthermore, a deliberate choice was made with respect to certain terms. For example, western, euro-centric, ‘age of reason’ and enlightenment; unless beginning a sentence, or denoting a proper noun like Europe or Western Sahara, remain uncapitalised. This is a choice to de-centre such indicators of formality that elevate euro-centric, western, and enlightenment epistemics and traditions. Conversely, African as an adjective is capitalised, to draw attention to and re-centre African epistemics. While this may seem a technicality, it offers an altered reading and consequently thinking experience. Lastly, the terms knowledge and epistemic are at times pluralised. As argued for in this study, this an acknowledgement of the plurality of local soil knowledges and also the value of a plurality of epistemics.

This thesis is the culmination of the author’s work (M. Milaras) on the research of *Africanising Soil Science: A Constructivist Grounded Theory For Advancing Curriculum Transformation* and entailed a series of national and international conference presentations and peer-reviewed articles that have been published in accredited journals. The research is listed below.

Krause, U., Rawlings Smith, E., Flajšhans Nedbalova, R., He, X., He, Y., Ito, N., **Milaras, M.** Yangi, J., Hanus, M. & Béneker, T. (2025). The barriers and enablers of curriculum thinking and teacher agency in geography education: A multinational study. *International Research in Geographical and Environmental Education*. 1-17. DOI: 10.1080/10382046.2025.2466160.

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German Environment Agency (UBA), Konrad-Adenauer Foundation (KAS), Makerere University (MAK) and Kampala International University (KIU) (2017). Outcome Document. *Proceedings of International Workshop “Legal instruments for the effective protection and sustainable management of soils”*. [M.Milaras, contributor]. Kampala, Uganda. 26-27 September 2017. URL: <https://www.umweltbundesamt.de/dokument/outcome-document-international-workshop-legal>. Accessed: 24 February 2025.

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EXECUTIVE SUMMARY

In Africa, social and epistemic justice imperatives call for the transformation of the western-style university, into an Africanised university. Ample literature exists as to the reasons that canonically-western university curricula should be Africanised to suit African needs. However, there is a lack of guidance on the process of Africanising scientific curricula, including in the discipline of soil science. To develop a useful theory in this regard, constructivist grounded theory (CGT) was applied as a methodology and method. A reflective teaching praxis, followed by in-depth interviews were conducted with experts in soil science, curriculum transformation, and indigenous knowledge studies. Transcripts were iteratively coded and abstracted to develop a CGT of a (South) Africanised soil science curriculum-transformation process. This theory encompasses interconnected personal, institutional, and national transformation processes, in a synergy of African (*ubuntu*) and Western (individualistic) approaches. The principles and process developed may support Africanisation of curricula in other environmental sciences.

Keywords:

Africanisation; Constructivist Grounded Theory; Soil Science; Curriculum Studies; Decolonisation; Indigenous Knowledge Systems; Ubuntu; Ethnopedology; Transformation Process; Epistemic Justice.

ABSTRACT

South African student protests of 2015/16 called for the decolonization of the university. Specific calls were made to Africanise the western university (rooted in enlightenment values) into a modern African university for Africans. Ample literature exists on the philosophical, moral, ontological, and epistemological reasons as to why (South) African universities ought to Africanise curricula. Here, the African philosophy of *ubuntu* (often précised to: ‘I am because you are’) features prominently; both as a guiding value and as an antidote to segregationist legacies of colonialism and Apartheid. Further literature points to the potential benefits of Africanisation. It argues that Africanisation of curricula would minimise epistemic alienation, increase relevance to local students, consequently, improve student success, and generate African knowledge to solve African issues. Well-accepted justifications for (African) student-centred learning are also advocated. Inclusion of indigenous and student knowledges is deemed an important factor in this transformation – so as to increase epistemic agency and local relevance. Nevertheless, there has been push-back from some at the idea that other epistemics may be valid and equal to, albeit different from, (western) science.

There remains however, little indication as to what a process of Africanising a curriculum may look like, or how this process may be gainfully engaged – particularly within an environmental science, such as soil science. Due to a lack of existing theory, Charmaz’s constructivist grounded theory was applied as methodology and method. Constructivist grounded theory was deemed fitting as it aligned with the researcher’s constructivist teaching philosophy and worldview. Moreover, Constructivist grounded theory’s tenet of the co-construction of knowledge is congruent with the researcher’s motivation for this study: to offer academic facilitators a more effective and empathetic means to inspire students’ co-discovery of meaning in, and deep engagement with, soil science. In a three-phase approach, a soil science textbook, as well as a curriculum and teaching praxis were first critically reflected upon. Subsequently, purposive and theoretically sampled semi-structured in-depth interviews were conducted with 26 experts in curriculum transformation, indigenous knowledge studies and soil science (saturation at ~30 hours of interviews). In the concurrent analysis of the data, an idiosyncratic constructivist grounded theory process involving theoretical playfulness, unfolded. Guided by memoing, codes were iteratively aggregated into progressively fewer theoretical categories, with increasing analytical and explanatory power. Firstly, to fracture but remain close to the data, initial coding was done line-by-line on printed transcripts. Subsequently, focused coding

was conducted page-by-page by synthesizing first level codes into encompassing second level themes. Further abstraction by theoretical coding was undertaken by: (1) intuitively and iteratively organizing printed slips of second level themes into third level categories, and (2) mapping memoed relations between third-level categories and abduction into theoretical concepts.

Synthesis of the foregoing produced a set of guiding tenets for advancing the Africanisation of a soil science curriculum. These were further theoretically abstracted into a constructivist grounded theory of a (South) Africanised soil science curriculum-transformation process. This grounded theory encompasses interconnected personal, institutional, and national transformation processes, in a synergy of African (*ubuntu*) and western (individualistic) approaches and may usefully be extended to other environmental sciences. The theory proffers that: by reflexive recognition of local limiting factors and injustices in these domains, the risk of transcending limits is overcome and transformation for inclusion of African epistemai is spurred; the continued momentum of which is fuelled by a student-centred desire for epistemic and social justice, while resistances are fuelled by fears of the unknown and accompanying loss of western scientific certainty and control. Moreover, such an Africanised curriculum is proposed as a site for new, socially distributed, epistemically just, African knowledge generation.

Keywords: Africanisation; Constructivist Grounded Theory; Soil Science; Curriculum Studies; Decolonisation; Indigenous Knowledge Systems; Ubuntu; Ethnopedology; Transformation Process; Epistemic Justice.

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LIST OF ACRONYMS

ADE – Amazonian Dark Earths
AfDE – African Dark Earths
B.C.E. – Before Current Era
B.P. – Before Present
C.E. – Common Era
CAQDAS – Computer Assisted Qualitative Data Analysis
CGT – Constructivist Grounded Theory
CHE – Council on Higher Education
DHET – Department of Higher Education and Training
DoE – Department of Education
FAO – Food and Agriculture Organisation
HBU – Historically Black Universities
IFIs – International Financial Institutions
IK – Indigenous Knowledge
IKS – Indigenous Knowledge Systems
IMF – International Monetary Fund
ISSS – International Society of Soil Science
IUSS – International Union of Soil Sciences
K–C–P – Kosmos, Corpus, and Praxis
LSK – Local Soil Knowledge
NRF – National Research Foundation
NWU – North-West University
OBE – Order of the British Empire
PASA – Publishers Association of South Africa
SA – South Africa
SAPs – Structural Adjustment Programmes
SAQA – South African Qualifications Authority
SCWG – Soil Classification Working Group
SDGs – Sustainable Development Goals
SOM – Soil Organic Matter
SSA – Sub-Saharan Africa
SSSSA – Soil Science Society of South Africa
STEM – Science, Technology, Engineering, and Mathematics

SUN – Stellenbosch University
TUT – Tshwane University of Technology
UFS – University of the Free State
UK – United Kingdom
UKZN – University of KwaZulu-Natal
UL – University of Limpopo
UN – United Nations
UniVen – University of Venda
UP – University of Pretoria
USA – United States of America
USD – United States Dollar
USDA – United States Department of Agriculture
USSR – Union of Soviet Socialist Republics
WIPO – World Intellectual Property Organization
WRB – World Reference Base
WSS – Western Soil Science
ZAR – South African Rand

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CHAPTER 1: INTRODUCTION

1.1 Background to the Research Problem

The recent calls for the Africanisation¹ of tertiary curricula in South Africa have vehemently questioned the hitherto accepted epistemic authority of the university. The student protests of 2015 and 2016 in particular pushed the Africanisation discourse into the public domain, which until then, had been a relatively contained academic debate (Le Grange, 2016; Angu, 2018; Letsekha, 2022). Nonetheless, the discourse around Africanisation at tertiary institutions is a long standing one, with diverse academic literature having been produced on the matter (Makgoba, 1997; Higgs, 2003; Parker, 2003; Le Grange, 2004; Waghid, 2004; Nakusera, 2004; Nkoane, 2006; Higgs & van Wyk, 2007; Metz, 2009; Louw, 2010; Prinsloo, 2010; Nsamenang & Tchombe, 2011; Letsekha, 2013; Msila, 2014; Waghid, 2014; Mbembe, 2016; Luckett *et al.*, 2019). That these debates range broadly and widely, speaks to the ongoing search for an ‘African’ identity, in a postmodern and postcolonial milieu (Makgoba & Seepe, 2004). Whilst the definitions of Africanisation (of the curriculum) are contested, there is broad agreement that the hegemony of western epistemologies in the university should be questioned. In particular, the absolute valuing of western scientific knowledge over all other knowledge systems has been fundamentally questioned in the postmodern age (Grenz, 1996; Letsekha, 2013; Hungwe & Ndofirepi, 2022). Furthermore, valuing a diversity of knowledge systems plays an important role in rectifying the inequitable legacies of colonialism and modernism, and the unintended social and environmental consequences of associated industrialisation. That is, by equally valuing multiple ways of knowing (including indigenous knowledges (IKs)), the ill-effects thereof may, at least in part, be remediated. A respect for, and implementation of diverse epistemologies, is thus a necessary part of curriculum transformation. In an African context, it requires concerted effort to Africanise the curriculum (Asabere-Ameyaw *et al.*, 2012; Ruitenberg & Phillips, 2012; Gill & White, 2013; Nkomo, 2013; Restrepo, 2014; Le Grange, 2016; Manthalu & Waghid, 2019; de Sousa Santos & Meneses, 2020).

Some proponents of Africanisation, however, maintain that western epistemologies should either be overthrown by, or incorporated into, African knowledge systems. A recent, albeit

¹ ‘Africanisation of curricula’ in this study is normatively defined as: appropriately conceptualising, contextualising, and tailoring a curriculum for students operating from, and in, an African context. Refer to Chapter 2 for a full discussion of the definition and its implications.

controversial, example of this is the University of Cape Town humanities student-protestor who called for western science to be “scratched off”, causing a social media storm under the hashtag: #ScienceMustFall^{2,3} (Ally & August, 2018; Harris, 2021). Such arguments for the Africanisation of science curricula are reactionary, simplistic and poorly-founded; and are thus problematic and unrealistic. Particularly, as the preponderance of modern-day scientific knowledge is produced outside of Africa (Pouris & Pouris, 2009; Pouris 2012). Rather, most proponents of Africanisation of African university curricula seek to: decentre euro-centric epistemologies in favour of locally appropriate African epistemologies, while also fostering synergies with western scientific thought (Waghid, 2002; Ogunniyi, 2004; Masemula, 2013; Sebola & Mogoboya, 2020). Africanisation of curricula has met with some resistance, particularly from scientific disciplines (Dick, 2014; Hungwe & Mkhize, 2022). However, a discipline such as soil science is not ‘un-Africanisable’, as there are abundant local (non-western) soil knowledges – these are nonetheless neglected in euro-centric university curricula (Pérez-Rodríguez *et al.*, 2023).

1.2 Research Problem

In the case of soil science, indigenous (or local) soil knowledge is a cornerstone of modern civilisation. That is, without such knowledge, modern agricultural plant domestication – as described by Vavilov’s well-known seven ‘Centres of Origin’⁴ – would not have flourished as it did (Hummer & Hancock, 2015; Choen & Loskutov, 2016). This is exemplified by Vavilov, who argued that in order to discover these centres, one had to “[look] in those few regions where primitive agriculture was still practiced, [...] wherefrom earliest times people have tilled the soil” (Popovsky, 1984:126 in Cohen & Loskutov, 2016). From these original centres of agricultural settlement, indigenous soil knowledge underpinned modern civilisation (Gong *et al.*, 2003; McNeill & Winiwarter, 2004).

Likewise, the Russian geographer and geologist, V.V. Dokuchaev, is considered the progenitor of modern soil science. He is famous for his original theory of pedogenesis dating back to 1879 (Bockheim *et al.*, 2005; Brevik & Hartemink, 2010a). Doucachev – the ‘father of soil science’

² <https://www.youtube.com/watch?v=C9SiRNibD14> [Accessed 30 December 2024]

³ <https://twitter.com/hashtag/sciencemustfall> [Accessed 30 December 2024]

⁴ Vavilov’s theory identifies seven regions globally where key cultivated crop plants were first domesticated.

– based his initial studies and classifications on vernacular Slovenian soil names (Krasilnikov & Tabor, 2003). Nevertheless, since the advent of ‘western’ soil science’s methods and taxonomies, indigenous soil knowledge has largely been ignored, and even suppressed, in favour of “modern [western]” practices and technologies (Dea & Scoones, 2010:463). Barrera-Bassols and Zinck (2000:11) state it bluntly: “[d]espite thousands of years of validation of ethnopedology by indigenous peoples, this has not been historically reflected in soil science research”. Moreover, indigenous soil knowledges are well correlated with both biodiversity and linguistic diversity (Barrera-Bassols & Zinck, 2002). Importantly, it can thus be seen that these IKs can contribute to understanding soils. However, contrary to this (and to science’s detriment) local knowledge has usually been side-lined or usurped (Krasilnikov & Tabor, 2003; Bargout & Raizada, 2013; Iloka, 2016).

The United Nations for example acknowledges that *both* traditional western science *and* IKs hold value. (Duyck, 2019). It has thus been argued that calls to Africanise science curricula are neither gratuitous, nor without material merit (Msila, 2007; van Wyk & Higgs, 2011; Garrote, 2024). Smith (2005) highlights the irony that, in so-called modern day ‘cutting edge’ botanical studies, IKs (once derided by western colonial settlers as founded in spurious superstition), are now the focus of intense and invaluable research in ethnobotany. In the case of soil science, the IKs of African and Amazonian Dark Earths (or *terra preta*) are providing new insights into ancient anthrosols with high fertility and carbon-capture properties (Glaser & Woods, 2004; Fairhead & Leach, 2009; Schmidt, 2013; Frausin *et al.*, 2014). Importantly, an acceptance and implementation of epistemological plurality is called for if sustainable solutions to the urgent problems of the current polycrisis⁵ are to be found (Williams & Brown, 2011; Maila & Seroto, 2013; Le Grange, 2024).

Furthermore, by disregarding the call to meaningfully integrate other knowledges with the western canon, there is a significant risk of a top-down approach to policies that address these problems. Such political resolutions to a fundamentally epistemological and pedagogic

⁵ “A polycrisis is not just a collection of many crises but is, rather, about how these crises interact in ways that amplify their overall impact and lead to devastating effects. Different stressors, such as environmental, technological, economic, political, and health-related issues, are increasingly interacting at a fast pace, creating unpredictable shocks of greater intensity. This interconnectedness of crises makes it challenging to address them in isolation since the compounded effects can lead to more severe and widespread disruptions. Polycrisis is the consequence of the dominant role that humans have played in altering planet Earth” (Le Grange, 2024:25).

problem are unlikely to result in deep curriculum transformation. This will negatively affect the education of future African scientists who need to tackle the complex African issues of sustainable development (Psacharopoulos, 1989; Skinner, 2003; Ramrathan, 2016). Morrel *et al.* (2022:11) conclude that “[q]uestions of inclusivity and transformation are central in higher education. In South Africa, these imperatives have the additional weight of post-apartheid redress. Attempts to address these questions seldom contemplate *how* transformation will be achieved.”⁶

Thus, there are pressing and long-term needs for scientists in westernised universities in Africa to engage proactively with expanding their epistemological horizons, and consequently their curricula. *How* one might engage in a process of Africanising a soil science curriculum however, remains poorly articulated. The question that consequently arises in this contested time and academic space is: *how*, and with what guiding tenets, might one meaningfully engage in the process of Africanising a soil science curriculum? This research seeks to interrogate this question within the context of the tertiary (university) discipline of soil science.

1.3 Research Aims and Objectives

The aims of this study are two-fold:

1. To identify a suite of guiding tenets which inform the process of Africanising a tertiary soil science curriculum.
2. To produce a theory as to how a pedagogue may deeply engage in the process of meaningfully Africanising an undergraduate soil science curriculum.

The following set of objectives will achieve the above aims:

1. Review the existing academic literature on Africanisation and curriculum transformation, alongside interrogating the epistemologies of (western) soil science, and indigenous soil knowledges.
2. Evaluate an undergraduate soil science textbook used in South African universities – in terms of its relevance to supporting teaching and learning in an African context.
3. Design and enact a soil science curriculum, explicitly founded upon pedagogical theory for epistemic access as a step toward Africanisation and document the outcomes as a reflective learning practice.
4. Conduct in-depth interviews with experts in the fields of curriculum transformation, soil science, and indigenous knowledge systems.

⁶ Italics added.

5. Utilize constructivist grounded theory methods to code and analyse the data.
6. Distil a set of guiding tenets that support pedagogues in developing an Africanised undergraduate soil science curriculum.
7. Formulate a theory detailing a process of how a pedagogue may engage in meaningfully Africanising a soil science curriculum.

1.4 Research Questions

The following research questions are proposed to interrogate the research problem:

1. What does the existing academic literature indicate about the negative effects of euro-centric curricula and epistemic alienation in African universities, and the potential for Africanisation of curricula to address this?
2. What does an analysis of the existing academic literature indicate about the tacit epistemics and biases of western and indigenous soil sciences?
3. To what extent does an 'in-use' undergraduate soil science textbook, prescribed in South Africa, support an Africanised soil science curriculum?
4. How do experts in soil science, curriculum transformation, and indigenous knowledge systems view the notion and practice of Africanisation within the context of teaching undergraduate soil science?
5. What reflections, on a pedagogical-theory-informed teaching practice of a soil science curriculum, are useful to furthering Africanisation?
6. What tenets are meaningful and useful to pedagogues in Africanising an undergraduate soil science curriculum?
7. What process can pedagogues engage/adopt/trace/employ/undertake/explore in developing an Africanised undergraduate soil science curriculum?

1.5 Research Design, Methodology and Methods

This study thus aimed to theorise as to the process of how a pedagogue might meaningfully undertake to Africanise an undergraduate soil science curriculum. This required a qualitative methodology within an overarching constructivist grounded theory (CGT) research design. To achieve the aim, a three-phase approach was used.

Firstly, using the literature as a critical lens, a selected prescribed undergraduate soil science textbook was analysed for its degree of African representation (as a proxy for Africanisation). The qualitative method applied here was that of content analysis. Secondly, an undergraduate soil science teaching praxis, specifically guided by pedagogical theory, was designed, enacted and reflected upon. In support of epistemic access and consequently a step toward Africanisation, a community of practice and action-reflection approaches were implemented. Thirdly, a database of experts in three germane academic fields was compiled, namely: soil

science, curriculum transformation (and Africanisation), and IK studies. These experts were identified through their departmental affiliation and their research. Snowball sampling was used to gather these participants for in-depth interviews (Secor, 2010). Interviews were in-depth and semi-structured; such that rich qualitative data was generated. Interview transcripts were manually and iteratively coded.

The foregoing data were inductively analysed, such that common themes were collated, and significant ideas synthesised (Charmaz, 2006; Chong & Yeo, 2015). This resulted in the production of supportive tenets for undertaking the Africanisation of a soil science curriculum. These tenets, and their interrelationships, were further abstracted to produce a CGT of how pedagogues may meaningfully engage a process of Africanising an undergraduate soil science curriculum.

1.6 Overview of Chapters

Chapter 1 provides a background to the study, identifies the research gap and argues for the need to address it. The chapter goes on to formulate this research problem as an aim and the objectives required to achieve the research outcome. It briefly delimits the study, discusses the methodology employed, and concludes with a summary of the thesis' chapters.

Chapters 2, 3 and 4 review pertinent academic literature to contextualise and motivate for the study. These three chapters investigate interrelated themes, namely Chapter 2: Africanisation and curriculum transformation; Chapter 3: marginalisation of global South epistemics in a soil science textbook; and Chapter 4: western soil science (WSS) and local soil knowledges (LSKs). This literature review begins by discussing (in Chapter 2) the arguments for Africanisation, and how this may draw on, *inter alia*, indigenous knowledge systems (IKS). In light of this, Africanisation as curriculum transformation literature is subsequently discussed – with a view to incorporating a plurality of epistemologies to address student alienation, and foster student success in the university and beyond. The argument is made that while the literature highlights the moral and epistemological value of Africanisation, there is little guidance on how to meaningfully embark on such curriculum transformation. Chapter 3 then discusses the contribution of textbooks to university curricula, and, as an indicative case study, critically

analyses a single undergraduate soil science textbook through the lens of Africanisation. Chapter 4 follows and provides an overview of modern, westernised soil science, by way of its: origins, evolution, epistemic structure, disciplinary importance, future directions and tacit biases. Subsequently, alternative epistemologies of soil knowledge are presented. It is argued that an inclusive epistemic approach would benefit both the discipline and student engagement. Efforts have been made to keep the discussion of these themes discreet. However, by the interrelated nature of this study, the discussion of these themes necessarily overlaps – to usefully contextualise, or juxtapose, facets of one theme with another.

Chapter 5 outlines the CGT research design and methodology employed to accomplish the study's aim. The chapter begins with an overview of research paradigms and designs – in which the researcher explicitly locates their worldview. The study's CGT methodology and methods are then discussed. The choice of CGT is justified by arguing its congruence with the researcher's worldview. Details of the interviews, participants and the data analysis are provided. The chapter concludes by discussing applicable data quality criteria and the ethical considerations of the data collection.

Chapter 6: details a teaching praxis and the reflective lessons learned. It provides the curriculum context and explicates the pedagogical theory which was implemented. The enacted curriculum's structural design and teaching approach are accordingly discussed. Based upon reflective research into this teaching praxis, limitations, recommendations, and a conceptual building-block contributing to the CGT are discussed.

Chapter 7: constructs and discusses tenets in support of Africanising a soil science curriculum. These tenets are constructed and discussed in the context of the literature and research data. These tenets comprise the focused and theoretical codes of the CGT.

Chapter 8: first presents the co-constructed theoretical building blocks which contributed to the CGT. It then goes on to detail and discuss a CGT which proffers an approach to meaningfully Africanising an undergraduate soil science curriculum. Additionally a process for epistemically

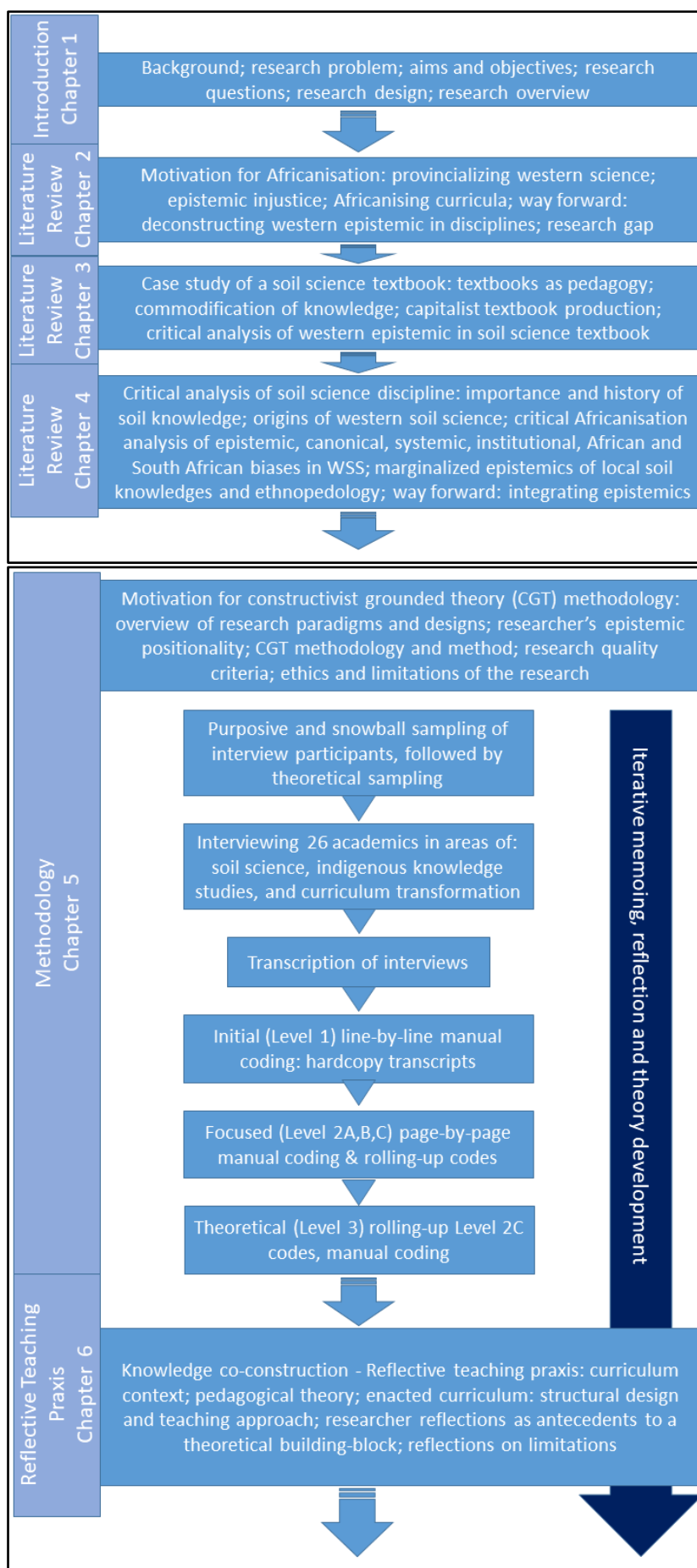
just situated and distributed African knowledge production is advanced. The CGT is then compared and contrasted with the existing literature in the research area.

Chapter 9: summarizes the study's key contributions, answers the research questions, and presents a consistency matrix to demonstrate internal research congruence. It then presents research reflections and proposed Africanising activities. Subsequently, it evaluates the study's success using reporting and quality criteria for grounded theory. It concludes with outlining the study's limitations, and proposes recommendations for future research and advancing the Africanisation of environmental science curricula.

It is important to note that CGT guidelines (Charmaz, 2006; Glaser & Strauss, 2006) advocate for CGT analysis to be conducted *after* an initial scoping literature review, but *before* an in-depth literature review (see Section 5.4 for details). This study was therefore chiefly inductively conducted and written-up in the following order:

- Chapter 1 – for the initial proposal, and broad overview of the research areas.
- Chapter 3 – an initial interrogation of the role of textbooks in Africanising curricula.
- Chapter 6 – an early teaching praxis, and reflective learnings from an initial attempt at Africanising a soil science curriculum.
- Chapter 5 – an in-depth understanding of grounded theory as methodology and method.
- Conducting and transcribing interviews – as directed by theoretical sampling and sustained by memoing and initial coding.
- Appendix 5.4 – focused and theoretical CGT coding analysis of data.
- Chapter 2 – an in-depth review of discourses of epistemic injustice and Africanisation.
- Chapter 4 – an in-depth understanding and deconstruction of western epistemics in soil science and the alternatives proffered by indigenous knowledges.
- Chapter 7 – a grounded, co-constructed synthesis of: the reflective experiences of Chapter 2 and 6; the literature in Chapters 2 and 4; and of the memos and coding analysis (Appendix 5.4) – resulting in a discussion of tenets for advancing the Africanisation of a soil science curriculum.
- Chapter 8 – presents (as ground in Chapter 7) theoretical building-blocks, their relationships, and the resultant abstracted CGT theory; subsequently compared to existing transformation theories.
- Chapter 9 – summarises and evaluates the study.

For ease of reference, Figure 1.1 below presents the research outline as a flow diagram in the chapter order.



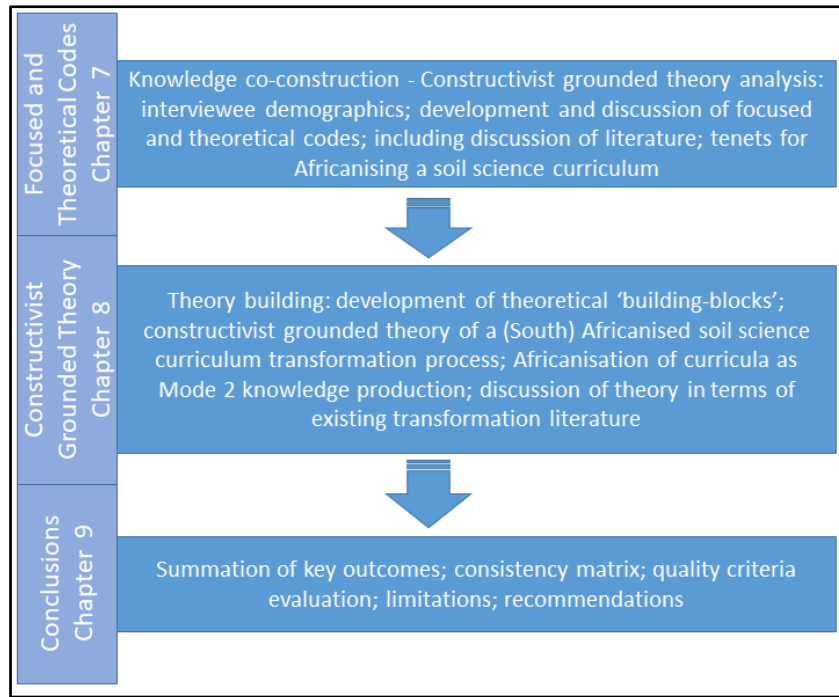


Figure 1.1: Research outline as a flow diagram by chapter.

CHAPTER 2: AFRICANISATION: AFRICAN EPISTEMICS AND THE TRANSFORMATION OF SCIENCE CURRICULA

2.1 Introduction

This chapter argues for the importance and benefits of an Africanising transformation of science curricula in African universities. It begins by outlining and critiquing the enlightenment context within which the scientific episteme developed. By probing its origins and concomitant assumptions, it is argued that modern western science is a value-laden, socio-culturally, historically situated way of knowing – as opposed to the most definitive way of knowing. The raising of science to totalising truth is then problematized as scientism. Subsequently, the postmodern epistemic turn – which critiques epistemic power structures and embraces diverse knowings – is discussed as a modern-day response to the shortcomings of the totalising epistemic of positivist enlightenment science. Post-positivist science is then explicated as a response to postmodern critiques. The chapter proceeds to argue that in South Africa, for various reasons, university science disciplines remain predominantly positivist in their curricula. This is then linked to the explicit calls for Africanisation of curricula by the #FeesMustFall and #RhodesMustFall student protests. The spiritual, material and epistemic oppression of Africans by both slavery and colonialism accordingly is presented as the moral basis for Africanisation. In this regard, particular attention is given to the epistemicide of African ways of knowing, as perpetrated by the colonial western episteme and its moulding of the university in Africa. This is followed by a brief historical account of Africanisation as a means which has sought to resist and overthrow this erasure of African epistemology. This is then contextualised in a discussion of post-apartheid national policy documents which have sought to effect Africanisation as a driver for redress, equity and transformation in the South African higher education sector. A discussion of the literature defining Africanisation follows, in the specific context of South African university curricula. The chapter then turns to a discussion of how Africanising such curricula may meaningfully engage alienated students. In this regard, epistemic alienation and its negative impacts on university students are first discussed. This is proceeded by an assertion that Africanisation of curricula (by way of embracing *ubuntu* and diverse ways of knowing) can begin to address this alienation of students, support student success, and further epistemic justice in Africa. The chapter concludes that for such Africanisation to be forwarded, first, inherent and inherited discipline-specific biases need to be identified – that they may be transcended, and meaningful curriculum

transformation forwarded. These arguments comprising this Chapter are summarised in a conceptual flow diagram, Figure 2.1 below.

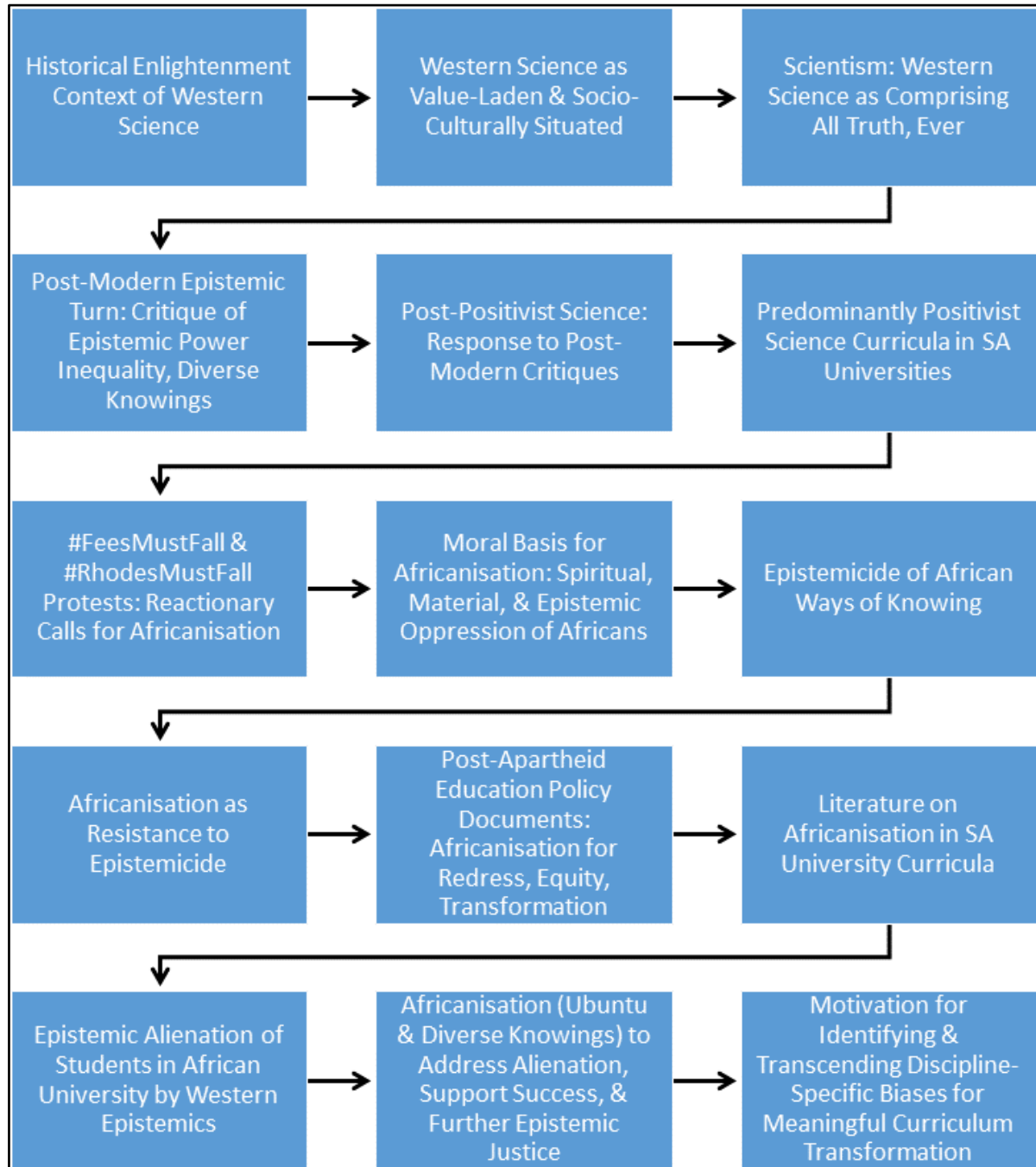


Figure 2.1: A conceptual flow diagram of the arguments presented in Chapter 2.

2.2 The Origins of Provincial Western Epistemics and Universalising Scientific Narratives: Science and the Western University in Africa

Europe, circa the 17th Century (1600s) saw the beginnings of ‘the enlightenment’, also known as the ‘age of reason’ or the ‘scientific revolution’, and was led by prominent thinkers like René Descartes, Baruch Spinoza, Francis Bacon, and Isaac Newton (Maldonado-Torres, 2006; Grosfoguel, 2012; Chirot, 2015; Ani, 2016; Fjelland, 2022). This enlightenment shift in thinking had its roots in ‘the renaissance’, which itself emerged from the intellectual fallows of Europe’s dark/medieval age (Olson, 1990). As with so many culturally-located philosophical movements, the enlightenment’s move embodied a *rejection* of the preceding humanist views of ‘Man *within* God’s Creation’. Thus, the enlightenment – which asserted ‘Man’s’ dominion over nature/the other, by disconnecting the two – “elevated the individual self to the centre of the world” (Grenz, 1996:15). The previously dominant western worldview, was based on the Christian church’s divine authority, traditions, and holy texts. Whereas this budding positivist thinking saw ‘Man’ as master of his own thought and consequently the natural world, rather than as a fated and meek being *within* ‘God’s Creation’ (Elkana, 1981; Bennett, 2007; Aikenhead & Ogawa, 2007; Chirot, 2015; Green, 2014). Grosfoguel (2012:88) put it as follows:

René Descartes, founder of modern philosophy with his motto ‘I think, therefore I am,’ understood the universal as an eternal knowledge beyond time and space; that is, equivalent to a God’s-eye view. In the struggle against the hegemonic Christian theology of the period (mid-17th century), [...] Descartes placed the ego at the foundation of knowledge in a position previously reserved for the ‘Christian God’.

And thus, it was from within this *very particular* (essentially ‘provincial’) socio-cultural historical setting, that modern western scientific thought was born (Grosfoguel, 2012; Kaviraj, 2023).

The enlightenment thinkers of the time (in this ‘oppositional move’ to the forgoing church-controlled philosophical and epistemic traditions), spearheaded the rise of ‘modern’ thought – and the resultant positivist epistemic (also see Chapter 5 for methodological details and implications of positivism). In this new *individual-centred* paradigm, the autonomous subject (the knower) – and object (the known) – were separated. That is to say, the knower asserted an ontological, moral, and epistemological superiority by knowing (defining) the known (nature/‘the other’). Consequently, the knower (western man), asserted the power to represent the known in (one) particular way. This positivist thinking claimed that it was – by way of

‘objective’ observation – that the observer (subject) could be separated from the phenomena (object) being observed. This ‘objective’ observation was considered objective, as it was grounded in the logic of the five senses and a mechanistic physical world (Love, 2014; Leibowitz, 2016; de Sousa Santos, 2018; Escobar, 2020).

The particular scientific method which emerges from the enlightenment is an appeal to generating knowledge from reason alone; a rejection of the preceding authority of church, faith, and revelation. By proceeding to the logical conclusions of such lines of thought, static scientific ‘facts and truths’ could be established about an object. The universe was, thus, simplified into: an ‘autonomous’ and ‘separate’ observer (self/subject), which made ‘objective’ observations and conclusions about a mechanistic universe (nature/other/object) – by application of the scientific method. Or, to put a finer point on it: *knowing* and *knowledge* were conceived as independent of the historical context and the lived experience of the human observer/subject/scientist (Agrawal, 1995; Grenz, 1996; More, 1996; Kolawole, 2005; Trochim & Donnelly, 2006; Owusu-Ansah & Mji, 2013; Boisselle, 2016). Grosfoguel (2012:88) similarly argues that, “to be able to claim the possibility of a knowledge beyond time and space, [...] it was fundamental to dissociate the subject from all bodies and territories; that is, to empty the subject of all spatial or temporal determinations.” Consequently the (enlightenment) assumption – that there is *one* ‘true’, ‘factual’, or ‘scientific’ way to know a thing/the universe – was entrenched in modern western thought. So, *prima facie*, the scientific conclusions which positivist logic arrived at were valid within their own self-referential rationale (Lincoln & Guba, 2013). In summation, the underlying *assumption* of an observer’s ‘objectivity’ and the resulting ‘truth’, were elided into creating an unassailable ‘factual’ view of the universe, nature, and others.

Grenz (1996:92) sums up the philosophical origin of the enlightenment movement as: “[r]eason replaced revelation as the arbiter of truth”. That is to say, individual human logic replacing divine (Christian church) authority in explaining and understanding the world. Grenz (1996:92-94) goes on to distil and explain the inherent principle beliefs of this ‘age of reason’ as follows:

1. Reason: “a fundamental order and structure lies within all of reality and is evidenced in the workings of the human mind.” The assumption herein is that the entire universe can be apprehended by the human mind’s logic. This results in a belief that by human logic all pre-existing universal laws can be revealed. This also presumes an objective

and rational ordering of the universe (which was mirrored in, and thus discoverable by, the mind). This resulted in the belief in the logical mind's capacity to (ultimately) comprehend, and thus master, the universe.

2. Autonomy: "autonomous human reason dethroned the reverence for external authority [the Christian church] as an arbiter of truth." This autonomy is characterised by the belief that each individual human's logic can discover the universal natural laws. The inherent belief is thus that each and every person must know and agree with the single logical and scientific truth of the universe.
3. Nature: "[the belief in] the very nature of things." That is to say, there existed readily discoverable (by way of reason) laws of nature and mechanical means of measurement, which governed and ordered the entire universe. This belief extended to the singularity of truth.
4. Harmony: "[the assumption] that the universe has an overarching order, that it is inherently reasonable and orderly." This resulted in the belief that any human behaviour or thought deemed illogical, would eventually succumb to the singular logical truth of universal scientific laws.
5. Progress: "The discovery and application of these [pre-existing natural] laws offered the promise of making humans happy, rational, and free." The preceding beliefs in the inalienable superiority of pure reason, resulted in a belief that the application of this reason was a moral responsibility in that it would forever improve humanity's circumstances, both materialistically and socially. Thus reason-driven progress became the incontrovertibly virtuous route to utopia.

The origins and founding principles of the enlightenment thus enabled "thinkers in the Age of Reason [to be] convinced that because the universe was both orderly and knowable, the use of the proper [scientific] methods could lead to true knowledge" Grenz (1996:93). Importantly, these (historical) philosophical assumptions, as embedded in scientific *method*, gave birth to a 'universalizing' *worldview* – wherein 'science as *method*' was elevated to 'science as *universal epistemic*'. This 'universalizing' worldview still largely underpins modern scientific thought, in which science has a monopoly on 'certainty' and 'truth' (Mignolo, 2009; Bennett, 2007; Grosfoguel, 2012; Gill & White, 2013; Medin & Bang, 2014; Martinez-Vargas, 2020; Radcliffe, 2022). See Chapter 4 and Appendix 4.1 for an analysis of the soil science discipline in light of these principles.

Taken to their logical conclusions, these foundational enlightenment beliefs of western science result in scientism. As defined by Olson (1990:8), scientism is the "wholesale extension of scientific ideas, attitudes, and activities to other domains". In other words, scientism is the *belief* that science and the scientific method are the *only* way to truly answer all and any questions about the world and reality. This unthinkingly involves dismissing all other epistemologies as 'second-rate' and fundamentally incapable of generating 'true' and

meaningful knowledge (Ani, 2016; Gasparatou, 2017; Peels, 2022). van Woudenberg (2023:424) terms this totalising belief as “disciplinary imperialism”. Rather, Ruse (2018:245) argues that, “[t]o say that science has limits detracts not at all from its glory. [...] by its very nature— by the very things that make it so successful— science is bound to have limits. [...] To claim that science does have limits is to respect what it can do and do very well indeed.” Various authors argue that, beyond science’s grasp, there are other sources of knowledge, including: experience, the evidence of the senses, clear and distinct ideas, tradition, authority, revelation, spiritual encounters, novelty, beauty, intuition, analogy, and morality; and other epistemological approaches, such as the philosophical, theological, humanistic and artistic forms, along with IKS (Elkana, 1981; Ani, 2016; Horsthemke, 2019; Peels, 2022). Most of these ways of knowing are generally maligned and disregarded by science – and yet they are major facets of countless peoples’ lived experiences (Hall & Tandon, 2017). Similarly, the ‘baked-in’ (enlightenment) assumptions that knowing can presumably be ‘separated’ from the socio-historical located being of the knower, exposes a fatal flaw in science’s claim to ‘universal’ knowing. As mathematician Henri Poincaré further contends, “It is often said that experiments should be made without preconceived ideas. That is impossible. Not only would it make every experiment fruitless, but even if we wished to do so, it could not be done” (Poincaré, 1905:159). Consequently, it can be appreciated that the tenants which undergird modern science’s claims to objectivity and universality, are formed and located within a particular (provincial) historic, geographic, and social context – which undermines their claim to universality.

In this regard, Kuhn, in his influential treatise *The Structure of Scientific Revolutions*, proposed a historiographic model which accounts for *discontinuous* changes in scientific paradigms (Kuntz, 2012). Kuhn (1970) advances that ‘normal’ scientific research accretes knowledge linearly under a well-accepted paradigm, with well-accepted precepts and methods. However, as with all research, there remain questions (and new findings) which the established paradigm – by way of its existing epistemology and practices – continually and irrevocably fails to accommodate. Yet, in practicing the established ‘normal science’, evidence of these failures accumulates. This leads to a ‘crisis’ of the inexplicable within the existing paradigm, and a consequent loss of faith in the paradigm’s explanatory powers. A ‘scientific revolution’ thus erupts, in which new conceptions with greater explanatory power emerge, and by necessity, ‘overthrow’ the preceding paradigm. These new ‘revolutionary’ conceptions subsequently

mature, becoming the basis for a *new* ‘normal science’. This new ‘normal science’ proceeds within its understandings, till it too fails to account for newer discoveries and is in turn rejected (Crotty, 1998; Nickles, 2017; Gare, 2018; Glattfelder, 2019, De Haro, 2020). Noteworthy is that these competing paradigms are incommensurable. They are fundamentally at odds with each other’s conceptions of science (Oberheim & Hoyningen-Huene, 2018). Or, as Glattfelder (2019:9) gives perspective to the assertion: “if a scientist is too deeply embedded and invested in a specific conceptual framework, worldview, or paradigm, he or she will be unable to understand the reasoning of an outsider scientist, constrained by their own paradigm. [...] In effect, *scientists are plagued by blind spots and other cognitive biases*⁷.” Modernist scientific assumptions, particularly positivism’s claim to universal truth, have accordingly been challenged by postmodern rebuttals (Jameson, 1984; Jarvis, 1998; Glattfelder, 2019).

It was in the historical context of the uncertainty of the 20th Century which the postmodernist movement arose; led by thinkers such as Nietzsche, Derrida, Foucault, and Rorty. Modernity’s positivist epistemic was rejected for, (1) its failures to account for the human experience; (2) its belief that all progress in knowledge is good; and that (3) science simply required time to solve all humanity’s problems. These assumptions of positivism were critically rejected in light of, *inter alia*: two world wars, the threat of nuclear Armageddon, the poisoning of the environment and collapse of natural systems, and the social failures of society (e.g. homelessness, drug addiction, poverty, malnutrition, violence etc.). Importantly, postmodernism argues that it is the human will to power (over the other) that drives the quest for knowledge; and that socio-cultural contexts shape knowledge, and give rise to the politics of knowledge (Linn, 1996; Allsobrook, 2014). Restated, postmodernism emphasises the complexity of being and knowing and the power relations therein, acknowledges that there are as many realities as there are people, and that the value of all knowledge is relative (Elkana, 1981; Stewart, 2003). Moreover, due to each person’s uniqueness of experience, these realities are incommensurate (Grenz, 1996). Critics of postmodernism argue that it is too tentative and inconclusive; and reject it for being inadequately analytic, empirical and objective (Kuntz, 2012). Stewart (2003:38) by contrast contends that the postmodern worldview “embraces pluralism and rejects modernist universalism that wanted to homogenize culture but which had the effect of destroying local culture.” The postmodern epistemic is thus a radical departure

⁷ Emphasis added.

from the modernist ideals of fundamental truths and universalising narratives. Modernist conceptions of the nature of reality, language, knowledge, truth and meaning are all disputed. On the contrary, postmodernism embraces relativism, deconstruction, and a focus on local narratives. It seeks to explore the inherent political dimensions of human ontology and epistemology, the impact of technology on society, the rise of global interconnectedness, and the need for a more ecological and inclusive worldview (Butler, 2003; Kahraman, 2014; Peters *et al.*, 2019). While the arts and humanities have critically engaged with the postmodern *zeitgeist*, and its critiques of modernity, the sciences seemingly lag in this respect (Morreria, 2015).

Within this milieu of the postmodern, the philosophy of science followed suit after its own manner. This turn toward post-positivism acknowledges the subjectivity of the observer in science, and consequently that all knowledge is fallible and subject to revision. In contrast to postmodernism, post-positivism still however maintains that a single reality remains ‘out there’. Even so, it goes beyond positivism in its acceptance of limitations in human perception and in that peoples’ unique socio-cultural being mediates their observations and interpretations of that one reality. Moreover, in comparison to positivism’s approach of validating hypotheses, post-positivism seeks rather to falsify hypothesis. Nevertheless, researchers should still strive maintain objectivity and not to influence the research process. As a consequence, the tentative nature of knowledge is emphasised, while retaining the importance of empirical evidence (and the attendant quantitative methods of data collection and analysis). Thus, while certainty is no longer regarded as absolutely attainable, the understanding of ‘*actual* reality’ can be *approached* by way of debate and the triangulation of scientific methods (Mackenzie & Knipe, 2006; Trochim & Donnelly, 2006; Bhaskar, 2009; Taylor & Medina, 2011; Moon & Blackman, 2014; Makombe, 2017; Potochnik, 2017). Nevertheless, in post-positivist science’s view, other epistemologies remain subordinate to its ultimate conception of reality; although post-positivism does allow for other validated contributions in its search for (its) ‘truth’. Richards (2015:6) for example contends that: “science as it stands today has many useful practical applications, but it does not have a metaphysical monopoly on the right way to talk about what *is*.” In spite of these contentions, post-positivism does allow for the beginnings of dialogue with other knowledges. This is of particular relevance considering the diversity within South African universities (Blackie, 2022).

While the philosophy of science may have shifted to post-positivist viewpoints, in the South African university, disciplinary science and its curricula often remain traditionally positivist in their outlook (Kirby, 2013). Causal in this, is that the model of modernist western university – its discreet disciplinary structuring and self-appointed validator of knowledge – which was imported into Africa (Ndofirepi, 2014; Mbembe, 2016; Naidoo *et al.*, 2020; Letsekha, 2022). Moreover, the unfortunate apartheid history of South African academia included complicit ‘objective’ positivist approaches, and also involved a degree of scientism. (Allsobrook, 2014; Soudien, 2015; Kirby & Dempster, 2018). As a significant portion of current academics received their education either during or shortly after apartheid, there remains an enduring legacy of such epistemic outlooks, which have also been perpetuated in their teaching. In such an intellectual milieu, scientific disciplines precluded for example: consideration of researcher bias, the impacts of social contexts in their investigations, and IKs. In this regard, Soudien (2015:27) argues that there was an “institutionalization into South African knowledge discourses of a distinct *othering*. [...] South Africa remains, as a result, trapped in a particularly problematic kind of modernist logic. This logic is unable to engage with the complexity of the social world it seeks to make sense of.” Thus the structure and social dynamics of the present-day African university persist in adhering to the modernist conceptions and assumptions of knowledge. This includes: the superior status of the sciences in their claim to defining ‘the truth of all reality’, and the division of knowledge into discreet disciplines (Brock-Utne, 2000; Haavelsrud, 2015; Badat, 2016). This monopoly on ‘valid’ knowledge production by the western academe in Africa has been termed epistemic imperialism and deemed an epistemic injustice in its marginalisation of other ways of knowing (Fricker, 2007; Kuokkanen, 2007; Bhargava, 2013; Ndofirepi & Cross, 2017; Gordon, 2018; Feldman, 2019; Patin *et al.*, 2021; Belluigi, 2023; Irzik & Kurtulmuş, 2024). In this regard, Makgoba (1997: 174) contends that universities in Africa generally remain epistemically subordinate to the “colonial motherland in a rather *imitative and replicative fashion*.”⁸

It is within this problematized context that, the initial 2015/6 #FeesMustFall and #RhodesMustFall protests, amplified calls for epistemic justice and curriculum transformation in the form of Africanisation (Hoppers, 2015; Langa, 2016; Le Grange, 2016; Luescher & Klemenčič, 2016; Ally & August, 2018; Fataar, 2018; Letsekha, 2022).

⁸ Emphasis in original.

2.3 Epistemic Injustice and the Africanisation Imperative

Before Africanisation can be defined, Maake (1997) argues that its impetus must be understood against the backdrop of the centuries of spiritual, material and epistemic oppression of Africans. Over the last 400 years, Africans have been subjected to *both* slavery and colonisation. The former paving the way for the latter (Settles, 1996; Nunn, 2008; wa Thiong'o, 2016; Heldring & Robinson, 2018; Thiaw & Mack, 2020; Freeburg, 2021). This has resulted in intergenerational trauma of genocide, kidnapping, subjugation, degradation, epistemicide, marginalisation, psychological servitude, eviction and dispossession (Césaire, 1955; Fanon, 1961; Hall, 1980; Patterson, 1982; Maldonado-Torres, 2007; Mignolo, 2009; Tuck & Yang, 2012; Králová, 2015; de Sousa Santos, 2014; Mbembe, 2016; wa Thiong'o, 2016; Michalopoulos & Papaioannou, 2017; Nunn, 2017; Broeck, 2020; Anyanwu & Ani, 2020). In no uncertain terms, Ngũgĩ wa Thiong'o (2016:89) sums up the causes and resulting inequalities, stating:

[T]he modern, to the extent that it has been shaped by capitalism, is a consequence of slave trade and plantation slavery. The economic consequences are obvious: the most developed countries in the West are largely those whose modernity is rooted in transatlantic slave trade and plantation slavery. The African body was a commodity; and its manpower, unpaid-for resource for at least 400 years. Plantation slavery morphed into colonial slavery in which, once again, African human and natural resources were cheap commodities for the colonialist buyer who determined the price and worth of that which he was buying. [...] Colonial slavery has morphed into debt slavery. It's not an accident that the major slaving states were also the major colonial potentates, just as today they are the major creditary states.

Much has been written on this grievous and multi-faceted subject (Césaire, 1955; Patterson, 1982; Mudimbe, 1988; Tomich, 1990; Gershoni, 1997; Ashcroft & Ahluwalia, 2001; Falola & Jennings, 2002; Gibson, 2004; Maldonado-Torres, 2004; Mignolo, 2009; wa Thiong'o, 2009; Miller, 2012; Maart, 2014; Maldonado-Torres, 2014; Grosfoguel, 2015; Králová, 2015; Mbembe, 2016; Gordon, 2020; Ashcroft *et al.*, 2024). It is however sufficient to the purposes of this study that this centuries-long physical and social destruction and oppression are deemed a chief moral reason to reclaim and renew African identities and epistemics – for without such freedom of self-determination, mental and moral subjugation persists.

Of particular relevance to this study, are the epistemicides perpetrated and perpetuated in Africa by the modern western epistemic, and more particularly science and the university (de Sousa Santos *et al.*, 2008; Gumbo, 2014; Fataar & Subreenduth, 2015; Maeso & Araújo, 2015;

Le Grange, 2016; Hall & Tandon, 2017; Angu, 2018; Ndlovu-Gatsheni, 2018; Kumalo, 2020; Patin *et al.*, 2021; Webster, 2021). Comaroff and Comaroff for example (2012:1-2) contend that:

western enlightenment thought has [...] posited itself as the wellspring of universal learning, of Science and Philosophy [...], it has [patronisingly] regarded the non-West — variously known as the ancient, the orient, the primitive world, the third world, the underdeveloped world, the developing world, and now the global south — primarily as a place of parochial wisdom, of antiquarian traditions, of exotic ways and means.

In articulating the resulting disenfranchisement of other epistemics, de Sousa Santos (1998) coined the term epistemicide. He defines epistemicide as the “murder of knowledge” (de Sousa Santos, 2014:92). Or, more specifically, the systematised eradication, devaluing and suppression of alternative knowledges, by and in favour of, the dominant euro-centric (or western) knowledge system (Grenz, 1996; Bennett, 2007; Grosfoguel, 2015; Le Grange, 2016; Hall & Tandon, 2017). Notable here is Kuhn’s (1970:5) assertion that “normal science [...] often suppresses fundamental novelties because they are necessarily subversive of its basic commitments.” Thus, by way of colonially backed epistemicide (*inter alia*, banning of indigenous rituals, religions, education and land ownership), the superiority of western science’s universalising epistemic was asserted in Africa (Shizha, 2013; de Sousa Santos, 2018). This has even been asserted in popular culture, for example by Gyedu-Blay Ambolley the Ghanaian singer-songwriter, in the lyrics of his 2017 song *Teacher*:

What they have been teaching us, is not African
Brain-wash education, is what they teach us every day
To carry on the legacy of the colonial master
My brother watch out, brother
That’s why black man they suffer
They want to be white, more than, white man

Many have argued that the ongoing and unquestioned superiority and hegemony of teaching and learning western science (specifically in African universities), marginalises and oppresses African ways of knowing, contributing to this epistemicide (see Fataar & Subreenduth, 2015; Grosfoguel, 2015; Hall & Tandon, 2017; Angu, 2018). In other words, with the valorisation of the production and consumption of western science, the modern structures of teaching and learning (particularly the university) aid ongoing epistemicide in Africa (Heleta, 2016; Mbembe, 2016; Shaik & Kahn, 2021). While not disputing that other epistemicides may have occurred throughout history, de Sousa Santos (2007) further argues that to address the ills of global social injustice, a critical focus must be turned toward the global epistemicides

perpetrated by modern western thinking. See chapters 3 and 4 for specific critique of the marginalisation of other epistemics within the discipline of soil science. Mbembe (2016) further argues that the western capitalist university model in Africa produces students who do not value study for knowledge's sake, but for its power to transform them into commodified human assets who can in turn sell their skills on the 'open' market. Thus, in gearing itself to the 'student-consumer', the university is itself commodified – thereby loses sight of its more fundamental and socially just mission of producing African solutions to African problems as a public good. Ali Mazrui (1993:119) is also very critical of the failure of African academics to grow an African Academe when he states:

The African university was conceived primarily as a transmission belt for Western high culture, rather than a workshop for the transfer of Western high skills. African universities became nurseries for a Westernised black intellectual aristocracy.

And similarly Mahmood Mamdani (1993:15) condemns the situation:

In our single-minded pursuit to create centres of learning and research of international standing, we had nurtured researchers and educators who had little capacity to work in surrounding communities but who could move to any institution in any industrialised country, and serve any privileged community around the globe with comparative ease. In our failure to contextualise standards and excellence to the needs of our own people, to ground the very process and agenda of learning and research in our conditions, we ended up creating an intelligentsia with little stamina for the very process of development whose vanguard we claimed to be.

It can thus be understood that knowledge of, and from, Africa has systemically been produced and read through the lens of a (foreign) western epistemic. The process of Africanisation is thus a means for Africa to reclaim epistemological freedom.

These preceding socio-historical understandings of modernity, and its shaping of the university in Africa, are valuable in contextualising and apprehending the attendant weighty decolonial critiques – which in turn – make imperative the Africanisation of curricula in the African university.

There is a history of the commitment to Africanisation as a move to reclaim marginalised African epistemics. Frantz Fanon's (1961, 1986) seminal writings for example, are an explicit resistance to the colonial erasure of African ways of thinking and being, and seek to affirm African existence. Ngũgĩ wa Thiong'o (1981:87) similarly affirms this "search for a liberating

perspective within which to see ourselves clearly in relationship to ourselves and to other selves in the universe.” Maake (1997:2) asserts that the string of historical African resistance movements – such as Negritude, Black Power, and Black Consciousness – are a move toward Africanisation in that “they sought to re-awaken, revive and re-assert Africanness.” As with most abstract academic concepts, the notion of Africanisation has morphed and evolved over time. The term Africanisation first became prominent circa the 1950s and 60s as colonial powers withdrew from the continent amongst a series of African independence struggles (Brizuela-García, 2006; Minga, 2020). This was followed by a resurgence in the mid and late 1990s correlating with the fall of Apartheid in South Africa, and another resurgence in the literature in the late 2010s correlating with the #FeesMustFall and #RhodesMustFall student protest movement (Kumalo, 2021) (see Figure 2.2).

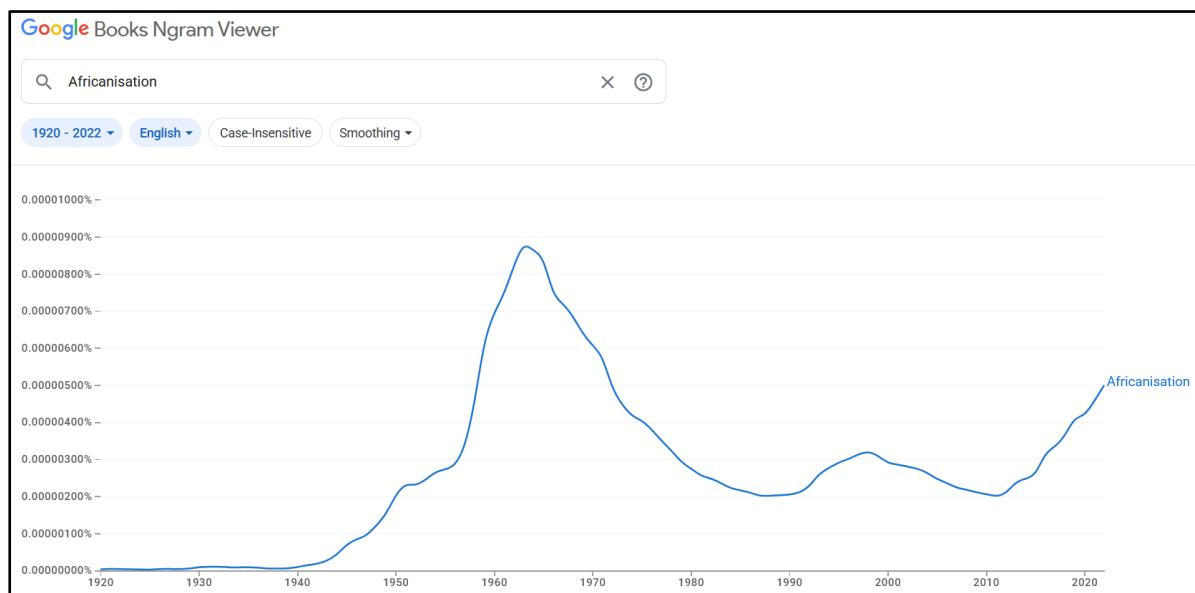


Figure 2.2: Ngram Viewer depicting the frequency of the term ‘Africanisation’ in the Google Books database (Google, 2023).

Thus, for decades, the literature has argued that for Africa to reassert itself as a global equal, Africa must reclaim its own identity and prioritise contingent epistemics (Falola & Jennings, 2002; Brizuela-García, 2006). Louw (2010) nonetheless goes so far as to posit that an Africanising paradigm shift has not yet occurred. It follows (wherein the university is a site of epistemic injustice), that Africanising tertiary curricula – in which students are offered the opportunity to see and connect with an Africanness which is positively reflected toward them

– is an important step in the transformation of the tertiary sector (Le Grange, 2016; Mheta *et al.*, 2018).

2.4 The Case for Africanisation of Tertiary Curricula

The Africanisation transformation imperative is particularly material in the sphere of education due to the discriminatory ‘bantu education’ policies of apartheid and their lasting deleterious legacies of inequality (Tabata, 1980; Meek & Meek, 2008; Allsobrook, 2014; Heleta, 2016). Accordingly, since the 1994 dawn of democracy in South Africa, and as part of wider societal redress, there have been policy-driven efforts to transform the country’s higher education system. The aim has been to be more accessible and inclusive to the majority of South Africans whom, based on race under apartheid, were discriminated against (Eckel, 2001; Joseph, 2017; Mzangwa, 2019). A key framework policy in this regard was the 1997 white paper, *A Programme for the Transformation of Higher Education* (Fiske & Ladd, 2004; Kumalo, 2020). The aim of this policy is (DoE, 1997:3): “to redress past inequities and to transform the higher education system to serve a new social order, to meet pressing national needs, and to respond to new realities and opportunities.” And subsequently, the goal most germane to this study (DoE, 1997:11): “[to] contribute to the advancement of all forms of knowledge and scholarship, and in particular, address the diverse problems and demands of the local, national, southern African and African contexts, and uphold rigorous standards of academic quality.” This seminal whitepaper directed transformation commitments in the subsequently legislated *Higher Education Act (Act 101 of 1997)*. Further commitments to transformation included policies such as: *The National Plan for Higher Education* (DoE, 2001), which outlined restructuring of the sector to boost massification of access; and the *White Paper on Post-School Education and Training* (DHET, 2013), which designates the equity and social justice aims of the sector (Cloete & Moja, 2005; CHE, 2022). It has since been demonstrated – viewed from a ‘gross student enrolment numbers’ perspective – that the tertiary sector has been transformed, as enrolments are largely on par with national population ratios (Ramrathan, 2016; CHE, 2018; van Schalkwyk, 2022).

Le Grange (2018:9) however argues that, although Africanisation may begin with the necessary first step of rectifying demographic representation, it is not truly realised until “African culture [becomes] the centre of Africa’s development.” Thus, as previously argued, academic

disciplines still remain largely untransformed in their epistemics, with African university students often alienated and their achievement thus hampered. So, while formal access to universities may have been provisioned, epistemological access has not been adequately realised. Africanisation and/or decolonisation of curricula has been posited as the socially just road to transformation in this respect (Morrow, 2009; Boughey, 2012; Adeyemo & Schoole, 2016; Le Grange, 2016; Ramrathan, 2016; Seepe, 2017; Luckett *et al.*, 2019; HSRC, 2023).

Africanisation while related to, is distinct from decolonisation and the decolonial project (Mbembe, 2016). Africanisation may contribute to decolonising a curriculum for example; even so, the decolonisation project reaches much farther, and is thus beyond the scope of this research. Hence, although some literature and much rhetoric use the terms ‘decolonise’ and ‘Africanise’ interchangeably (Mheta *et al.*, 2018; Kumalo, 2021), here they are not. Decolonisation points to dismantling the domination and legacy of vast colonial systems and power structures, so as to re-establish equity and human dignity in a postcolonial milieu (Heleta, 2016). While here, Africanisation denotes choosing to operate from an African ‘centre’ by fostering African identities and epistemics (wa Thiong’o, 2008; Heleta, 2016; Ajani, 2019). It must also be noted that the definitions of Africanisation discussed here *do not* probe the similar yet differing (Suárez-Krabbe, 2017) conceptualisations of, or reasons for, Africanisation from the perspective of global North universities. Rather, this research is concerned with Africanisation – as centred in and by – efforts to engage in Africanising a tertiary curriculum. To reiterate, this research appertains itself with Africanisation, and thus, only by extension decolonisation (insomuch as Africanisation is a facet of the decolonial project). It must also be remembered that Africa is a continent, and a diverse one at that⁹; hence this study limits itself to investigating the process of Africanisation within the soil sciences discipline in South African universities.

Useful for its encompassing power, and widely cited, is Makgoba’s (1997:66) definition of Africanisation:

⁹ Le Grange (2018:10) justifies the broadness of the term thus: “Africanising is a unifying concept that involves the undoing of colonialism on the continent, but manifests in nuanced ways in different countries or regions.” Thus, while Africa is inherently plural, unity can be reached for by way of centring the African experience in overturning of the mantle of coloniality.

[Africanisation] is a learning process and a way of life for Africans. It involves incorporating, adapting and integrating other cultures into and through African visions to provide the dynamism, evolution and flexibility so essential in the global village. Africanisation is the process of defining and interpreting African identity and culture. [...It] has endured and matured over time from narrow nationalistic intolerance to an accommodating, realistic and global form.

Falola and Jennings (2002:1) posit a pared down definition and speak of the imperative process by which African knowledge must become “more African”. Letsekha (2013) articulates that Africanisation recognises that African ways of being and knowing are not inferior, but equal to other (western) ontologies and epistemologies. In turn, Msila (2014) focuses on the African perspective and world view, through which experience and knowledge are (should be) apprehended and produced. Ndofirepi & Cross (2017) speak to a need for epistemic emancipation, as spearheaded by the Africanisation of the university, by listening to African voices and placing the African contextual experience at the centre of the university. They continue that this process of Africanisation should be engaged with for reasons of social and epistemic justice by prioritising relevant African knowledge production for African needs; while remaining connected to a globalised world and not digressing into nostalgia and a nationalistic narrow-mindedness. Mkandawire (2005) similarly advocates an inclusive Africanisation movement as a moral imperative for survival. Ndlovu-Gatsheni (2018:19) contends that the process includes “demythologising both the idea of Europe as a teacher of the world and the idea of Africa as a pupil.” While Nyamapfene & Ndofirepi (2017) highlight the need for a meaningful turn toward an African paradigm, which does not – in a reactionary manner – result in disconnection from the globalised world. And, Ndofirepi & Cross, (2017:7) conclude that a socially just Africanising transformation would: “prioritis[e] African values in determining worthwhile knowledges to be pursued by universities in Africa.”

Interestingly, in the 1960s Fanon rejected the term, as he deemed Africanisation as the mere replacing of the colonial elite with African elite (Mheta *et al.*, 2018; Le Grange, 2019). Nonetheless, the term has been since reclaimed to encompass both demographic and cultural decolonisation (Le Grange, 2018). There have also been academic debates as to the appropriate meanings of the term (see for example, Parker, 2003; Higgs, 2003; Le Grange, 2004). While Maake (1997) warns that Africanisation must be genuinely enacted without undermining its meaning by the superficial romanticization of Africa. A few authors, like Dick (2014) and Zulu (2023), contend that Africanisation is parochial and unattainable in a globalised world.

Horsthemke (2006) however argues that polarised Afrocentrism or Afroscepticism are divisive and counterproductive. And More (2002) contends that Afropessimism is yet a further attempt to obstruct African transformation. Moreover, Suárez-Krabbe (2017:71) points out that nothing is clear-cut about a ‘return to Africanness’ in a globalised postmodern world, as:

we cannot speak of any ‘culturally clean’ nor ‘separate’ people, inasmuch there has been mutual influence between us, most notably the influence of the process of colonisation with its violent imposition of religion, custom, sexuality, knowledge, etc. but also through processes of epistemic extractivism.

There is thus the danger of being caught in the false dichotomy of *either* African *or* western. An obvious example in this regard is the notorious #ScienceMustFall¹⁰ incident (Ally & August, 2018; Harris, 2021; Blackie, 2024). Nyamapfene and Ndofirepi (2017:89) contend that epistemologies in the humanities have evolved to be more mutable, and thus may more easily be Africanised; while the ridged positivist paradigms of the natural sciences resist change and make a move toward Africanisation difficult, which “certainly begs the question of how to create a [lived] university experience that reflects the needs and realities of Africa.” Nevertheless, academics whom are advocates of Africanisation agree that the route forward is equitable, inclusive and synergistic, rather than a binary or exclusionary one (Waghid, 2002; Ogunniyi, 2004; Masemula, 2013; Sebola & Mogoboya, 2020). Letsekha (2013) concludes that an Africanising transformation of tertiary curricula will be a protracted (un)learning process which will require the deconstruction of entrenched western academic identities.

Despite the details of the definitions of Africanisation varying between authors, and at times even being contested, overall, Africanisation seeks to resist and remedy the systemic deprivations and marginalisations of Africans. Most definitions of Africanisation thus emphasise the primacy of, a return to, a centring of, a focusing on, and a valuing of, *inter alia*, African epistemics, contexts, experiences, cultures, identities, languages, localities and pedagogies – and thus capacitating ourselves to build a relationship with western knowledge

¹⁰ <https://www.youtube.com/watch?v=b6UqxNsyZ7M> [full version, accessed 17 December 2024].
<https://www.youtube.com/watch?v=C9SiRNibD14> [short version, accessed 17 December 2024]

In 2016, a student activist at the University of Cape Town called for science to be “scratched off” and done away with in the African university. This instigated a viral and racist backlash, which arguably undermined otherwise valid arguments in the call to decolonise science (Ally & August, 2018; Harris, 2021).

and culture on an equal footing (Maake, 1997; Falola & Jennings, 2002; Horsthemke, 2004; Nkoane, 2006; Louw, 2010; Letsekha, 2013, Sebola & Mogoboya, 2020).

In consideration of the forgoing definitions, ‘Africanisation of curricula’ in this study is normatively defined as: appropriately conceptualising, contextualising, and tailoring a curriculum for students operating from, and in, an African context. Africa (as part of a globalised world), is thus axiomatically affirmed as the core of the epistemic, while balancing and gainfully including western and other epistemologies, so as to avoid an intolerant Afrocentrism, while generating socially just African solutions to African challenges (Letsekha, 2013). In summation, it can be noted that the central to these definitions of Africanisation are: (1) the centring of Africanness, (2) the equitable integration with western epistemics, and (3) the process-based nature of this transformation. The chapter now turns to discussing the premise that Africanising university curricula seeks to support alienated students.

The aforementioned university student protests powerfully foregrounded that African students are palpably alienated by euro-centric university structures and curricula (Ndlovu-Gatsheni, 2018). Alienation has been professed since Karl Marx (Raekstad, 2022) and was contextualised in education in Africa in Fanon’s *Pedagogy of the Oppressed* and *Alienation and Freedom* (Freire, 1970; Fanon, 2018). In this regard, Jaeggi (2014:25) broadly defines alienation as “a detachment or separation from something that in fact belongs together, the loss of a connection between two things that nevertheless stand in relation to one another.” Accordingly, the concept has been discussed widely in the literature on teaching and learning; and highlights the hurdle of epistemic alienation which African students face in meaningfully relating to the university and engaging with its curricula (Honikman, 1982; Fanon, 1986; Loo & Rolison, 1986; Leon & Lea, 1988; Badenhorst *et al.*, 1990; Cobern & Aikenhead, 1997; Kagee *et al.*, 1997; Matos, 2000; Stein *et al.*, 2001; van Wyk, 2002; Sennette *et al.*, 2003; McKenna, 2004; Nakusera, 2004; Dei, 2007; Fricker, 2007; Shizha, 2010; Nyamnjoh, 2012; Babaci-Wilhite & Geo-Jaja, 2014; Msila, 2014; Chetty & Pather, 2015; Mutekwe, 2015; Leibowitz, 2016; Naidoo, 2016; Hall, 2018; Mheta *et al.*, 2018; Dison *et al.*, 2019; Janks, 2019; Milaras & McKay, 2019; Belluigi & Thondhlana, 2020; Motala *et al.*, 2021; Seehawer & Breidlid, 2021). Thus African students – operating in a postmodern world and African locale – can be alienated from western and positivist epistemics in science.

As previously contended, the university is a progenitor of euro-centric epistemics; and its overbearing epistemic totalitarianism dismisses other ways of knowing. African students however arrive in this ridged setting with their own enculturated worldviews, lived experiences, and knowledges. Thus, predominantly white and euro-centric culture and epistemics – as normative in the university – are often alienating of African ways of being and knowing respectively (Kuokkanen, 2007; Malabela, 2016; Adonis & Silind, 2021; Batisai *et al.*, 2022; Knowles *et al.*, 2023). Barry (2024) provides examples of the manifestly modern form of alienation, including a sense of: unreality, insincerity, disassociation, objectification, loneliness, disorientation, estrangement, insecurity, bondage, absurdity, depersonalization, tedium, disempowerment and unbelonging. In this regard, Badat (2016:7) argues that “[at South African] universities [there remains] a deeply embedded culture of whiteness that has yet to yield to substantive respect for and affirmation of difference and creation of inclusive institutional cultures.” The normative euro-centrism in curricula could be considered as a form of ‘hidden curriculum’, which African students have to work harder to navigate and risk disengagement (Portelli, 1993; Kidman *et al.*, 2013). Alienation in the university has accordingly been classed as socio-cultural and/or academic – which can broadly be mapped as ontological and epistemic, respectively (Loo & Rolison, 1986). Although inexorably linked, it is epistemic alienation and its bearing on engaged learning, which is focused upon here.

Letsekha, (2022:74) argues that the epistemic foreignness of the university negatively impacts: “[b]lack [African] students in particular [–] there is an expectation that they will assimilate unfamiliar norms, customs and academic language in spaces that are not very accommodating of their presence or identities.” African students in the transition to university, are additionally more likely to be ‘first in family’ to attend university, face financial difficulties, have extended familial responsibilities, and not be first-language English speakers – all which compound the pressures of performing academically within a foreign epistemic (Sennett *et al.*, 2003; Chetty & Pather, 2015). Moreover, African students’ voices are silenced and engagement hampered in the classroom, as their knowledge is neither reflected in, nor elicited by, euro-centric curricula (Angu, 2018). For example, in a student-centred workshop, Knowles *et al.* (2023:4) reported that common to experiences of alienation in the university “students [felt] unrecognised by the kinds of [canonical] text[s] they are presented with and [thus] are unable

to make meaningful contributions in class discussions or assignments.” Importantly, it has been successively been demonstrated that the alien, yet pervasive, euro-centric epistemic has direct negative consequences on African students’ academic performance in the university (Loo & Rolison, 1986; Kagee *et al.*, 1997; Luckett, 2011; Sikhwari *et al.*, 2019; Naidoo *et al.*, 2020; Papageorgiou & Callaghan, 2020; Hall *et al.*, 2021; Motala *et al.*, 2021; Batisai *et al.*, 2022). Omodan, (2024:2) summarises this present situation thus:

University education, a significant vehicle for knowledge dissemination and creation, is currently entangled with prevailing power dynamics that are deeply entrenched within its foundational structures, pedagogies, and curricula. The dominance of Western epistemological frameworks has significantly influenced the dissemination and validation of knowledge within academic settings, subsequently marginalising non-Western, Indigenous, and alternative knowledge systems. This dominance contributes to a continuous cycle of unequal power relations, exclusion, [alienation,] and marginalisation of diverse voices and perspectives, impacting students’ learning experiences and outcomes from varied backgrounds.

While the university has been implicated in perpetuating epistemic injustice, it remains a site with significant potential for transfiguration – into a trailblazer of change and African empowerment. As argued by Lumadi (2021:2):

universities themselves need to be reimagined [and transformed] to become in tune with today’s context. People are more connected than ever as a global community [...] Climate change, political and social polarisation, inequality – these are complex global challenges that demand a broad range of strategies and perspectives. Yet, many universities’ convoluted curricula still have their roots in the late 18th and early 19th centuries, when the world was a very different place.

Africanisation of curricula has consequently been posited as a socially just transformation which would positively impact African students, their academic performance, and support epistemic emancipation in Africa (Le Grange, 2014; Bozalek & Zembylas, 2017; Luckett & Shay, 2017; Angu, 2018). The Africanisation of tertiary curricula seeks to connect with, otherwise often alienated students, so as to foster belonging and deep epistemic engagement, as opposed to disconnection (Louw, 2010; Letsekha, 2013; Higgs, 2016). Encouraging deep learning by fostering student agency has been a cornerstone of the discourse for some time (see for example, Freire, 1970; Nyerere, 1971; Vygotsky, 1986). Thus reflections of local (indigenous) and student knowledge in curricula can nurture learning, wherein students can reclaim their sense of learning agency and can come to feel epistemic confidence (Gitari, 2012; Cullinan Cook, 2019; Knowles *et al.*, 2023; Blackie, 2024). Moreover, as argued by Fournier and Gregory (2024:101): “[o]ne of the main factors contributing to student satisfaction is the

extent to which students feel connected to each other and to their instructor.” Such approaches aim to enrich educational experiences, deepen learning, promote cultural pride, nurture students’ learning agency, address historical injustices, stimulate critical thinking, and equip young people with the tools necessary for navigating the complexities of modern Africa (Msila, 2009; Prinsloo, 2010). Knowles *et al.* (2023) add that socially just knowledge production in universities should seek to resonate with individuals’ holistic identities – including their political, social, economic, cultural, and spiritual contexts – so as to promote success and critical thinking by enabling deeper understandings of their past and future. Luckett and Shay (2017:3) accordingly argue that “curriculum transformation, [which] offers ‘parity of participation’ to those from the South, is not only a matter of justice but an ethical responsibility, to be worked out politically and practically with those affected.” Omodan (2024:1) additionally conclude that “[such transformation is] pivotal for fostering environments steeped in inclusivity, equity, and social justice within the [problematized] university education landscape”.

Importantly, Africanisation of curricula should not be narrow in its conception. Rather, it can seek to ground the curriculum in diverse student and local African epistemics and realities, as opposed to reified euro-centrism (Higgs, 2016; Angu, 2018). This diversity is a strength of Africanisation (Etieyibo, 2016). With diverse student identities and knowledges welcomed and included in such curricula and classrooms, the contrived racist apartheid dichotomy of ‘black or white’ may be transcended. Instead of relying solely on a euro-centric canon, synergies with local knowledges can bring multiple theoretical frameworks to bear – such that ‘local solutions to local problems’ can be leveraged (Tuhivai Smith, 2008; Naidoo, 2016; van Stam, 2019). Fataar (2018:vii) further argues that such curriculum transformations should be “based on the inclusion of all knowledge forms bequeathed to humanity including African, indigenous, Arab-Islamic, Chinese, Hindu, Indo-American, Asiatic, and Western knowledge forms.” Thus, developing research and teaching foregrounded in African intellectual traditions, which also rigorously engage other epistemics, may advance meaningful and critical Africanisation of curricula (Naidoo, 2016).

2.5 Directions in Africanising Curricula

It is variously acknowledged that in the African university, Africanising curricula in a diversification away from the centrality of a euro-centric canon, would involve meaningfully centring an African epistemic by engaging with, *inter alia*: student knowledges, African culture (e.g. beliefs and values), and IKs (Le Grange, 2004; Nkoane, 2006; Louw, 2010; Prinsloo, 2010; Asabere-Ameyaw *et al.*, 2012; Msila, 2014; de Beer & Petersen, 2016; Reddy *et al.*, 2017; Padayachee *et al.*, 2018; de Jager, 2019a; Meda, 2019; Cullinan Cook, 2019:67; Naidoo, 2020; de Beer & Kriek, 2021; Khumalo, 2023).

Students do not arrive at the university as a ‘blank slate’, ready to be passive receivers of knowledge, but rather already containing their own experiences, knowledge, and values (Stephens, 2000; Power & Holland, 2018). Thus, to mitigate alienation and foster engagement, student knowledge should be acknowledged and ways found to usefully leverage it for deep learning (Cullinan Cook, 2019). As Power and Holland (2018:125) exemplify: “[e]ach student’s previous experience not only makes their learning individual, but also has the potential to enrich the learning experiences of their peers”. Such understandings are well-accepted pedagogical considerations, with concepts such as ‘adaptation’, ‘zone of proximal development’, ‘community of practice’, and ‘scaffolding’ theorising their meaning and implementation (Piaget, 1964; Vygotsky, 1978; Ertmer & Newby, 1993; Biggs & Tang, 2011; Hoadley, 2012; Milaras & McKay, 2018; de Jager, 2019b; McLeod, 2024). There is also a suite of research which argues for the further transformative step of teaching and learning in African languages (see for example: Babaci-Wilhite, 2014; Jacob *et al.*, 2015). In science disciplines however, a positivist epistemic (and its previously problematized ‘superiority complex’) can result in a behaviourist pedagogy, which expects to successfully transmit knowledge to students. On the other hand, a constructivist pedagogy (a more relativist, postmodern approach) acknowledges learner agency in constructing their own understandings and knowledge (Addison, 2014; Murtonen, 2017; Agarkar, 2019). Although there is much more complexity and nuance to pedagogical theory and practice, this generalised classification can be helpful to make broad distinctions in teaching approaches (Mansour, 2009). Due the actual value realised in teaching and learning – of the integration student knowledges in curricula (contrary to convention) – such student-centred approaches have been argued as being vital to an Africanising transformation (Blackie *et al.*, 2010; Le Grange, 2019; Shahjahan *et al.*, 2021). Knowles *et al.* (2023:3) for example argue that “[student] voices [...] from the margins can intervene at distinct moments [in the curriculum] to envision new ways of being human and to

produce future possible worlds.” Cullinan Cook (2019) concludes that educators’ ‘deficit thinking’ (the negative framing of student ‘under preparedness’) can be gainfully overcome by actively appreciating (positively framed as ‘surfeit thinking’) the developmental value in the diversity of epistemics and student knowledges brought to a constructivist educative setting.

Such understandings are further useful in a South African setting, where students may be enculturated with IK; or, if not specifically possess it, they may identify it with their African heritage (Ngara, 2007; Le Grange, 2014; Jacob *et al.*, 2015; Khumalo, 2023). Le Grange (2018:11) for example categorically states that “Africanising could and should involve the inclusion of African indigenous knowledge in social and education processes.” However, western science curricula have historically precluded IK (Asabere-Ameyaw *et al.*, 2012; Blackie, 2024). Garrote (2024:6) argues that there is an “urgent need of diversity of perspectives, traditionally restricted to Western scientists [... as indigenous perspectives can ...] foster innovative solutions and broader understanding[s]”. Accordingly, IKs (either that of the students, or the community in which the university and students may engage with), has been deemed important in Africanising curricula – from viewpoints of both epistemic justice and epistemic diversity (Msila, 2007; Sayed *et al.*, 2007; Nyamnjoh, 2012; Ani, 2013; Webb, 2016; Agbaje, 2023). Blackie (2024:10) for example supports this by arguing that the integration of IKs in university science curricula can foreground indigenous wisdom and promote cultural relevance, student self-esteem and motivation, and also foster deep learning experiences, all while displacing “the classic image of the scientist as a white, heterosexual, cisgendered male”. While Ani (2013) further agrees by critiquing the blind reductionism of a western mono-episteme, and argues that holistic understandings and sustainable solutions (in a time of multiple environmental crises) may be advanced with the meaningful integration of diverse IKs. In this regard, Mbembe (2016) proposes that a ‘pluriversity’, replace the problematized university; wherein this pluriversity is a palace for: “a process of knowledge production that is open to epistemic diversity [...] which embraces it [(knowledge)] via a horizontal strategy of openness to dialogue among different epistemic traditions [(e.g. IKs)].” In this regard, this ‘*pluri*-versity’ is juxtaposed as a generative counteragent to the problematized ‘*uni*-versity’ (Sebola & Mogoboya, 2020). IKs, as related to the discipline of soil science, are accordingly discussed in more detail in Chapter 4.

Lastly, in consideration of African culture¹¹, *ubuntu* can broadly be deemed an African worldview (Patel *et al.*, 2024). It has variously been designated as an African philosophy, ideology, ethic, moral quality – effectively an amalgam of epistemology, ontology and axiology (Ramose, 2004; Idoniboye-Obu & Whetho, 2013; Seehawer, 2018; Nyamnjoh, 2020). In this research however, the debates around semantics of *ubuntu* are overlooked in favour of its conceptual power as a shared African perspective. Many authors accordingly argue that a route to Africanising education is by way of the foundational incorporation of *ubuntu*, its philosophy and values (Higgs, 2003; Ramose, 2004; Msila, 2009; Le Grange, 2011; Waghid, 2014; Takyi-Amoako & Assié-Lumumba, 2018; Seehawer, 2018; Eybers & Paulet, 2020; Nyamnjoh, 2020; Hungwe & Ndofirepi, 2022). *Ubuntu* is defined by Le Grange (2011:69) as being “aware of one’s own being, but also of one’s duties towards one’s neighbour”; which has often been précised to: ‘I am because you/we are’. This shows a clear contrast with the Cartesian individualism of ‘I think, therefore I am’, and points to the foreignness of western thought in Africa (Idoniboye-Obu & Whetho, 2013). Mbiti (1990:106) further states that the reciprocal implication of *ubuntu*’s meaning is “since we are, therefore I am”; that is to say, personhood depends on others. Accordingly, *ubuntu* can be translated to ‘humanness’, wherein community is integral; it is thus an especially communitarian and humanising viewpoint. Again, this is in stark contrast to the western subject/object disassociation (Le Grange, 2011; West, 2014; Seehawer, 2018; Hungwe & Mkhize, 2022). Particularly illustrative in this regard is Table 2.1 of Mawere *et al.*’s (2016) juxtaposition of western and African traditional values.

Table 2.1: A comparison of the dissimilarities between western and *ubuntu* modes (Mawere *et al.*, 2016:10).

Ubuntu Tradition	Western Tradition
Relation	Ratio
Who	What
Community	Individual
Responsibilities	Rights

¹¹ “The overarching philosophy of Black people of Africa is named differently in African communities and languages. Some communities and ethnic groups in Angola call it gimuntu, Botswana (muthu), Burkina Faso, Cote d’Ivoire, Equatorial Guinea, Guinea, Gambia Liberia, Sierra Leone and Mali (maaya), Burundi (Ubuntu), Cameroon (bato), Congo (bantu), Democratic Republic of Congo (bomoto or bantu), Ethiopia (medemer), Ghana (biako ye), Kenya (utu, munto or mondo), Malawi (umunthu), Mozambique (vumuntu), Namibia (omundu), Nigeria (mutunchi, iwa or agwa), Rwanda (ubuntu), South Africa (ubuntu or botho), Tanzania (utu, obuntu or bumuntu), Uganda (obuntu), Zambia (umunthu or ubuntu) and Zimbabwe (hunhu, unhu, botho or Ubuntu) [...] Linguistically, most of the names have a common root. [...] its origin is attributable to Black Africans as a whole — North, West, East, Central and South of the continent.” (Mugumbate *et al.*, 2023: 1123).

Relationships	Goods
Character	Credentials
Member	Actor
Paradox	Consistency
History	Future
Orality	Literacy
Authority	Power
Proven	Emerging
Reactive	Proactive
Paradox	Consistency
Elaborate	Concise
Existence	Essential

The ethos of *ubuntu* includes values such as: respect, humility, empathy, honesty, dignity, tolerance, harmony, unity, interdependence and connectedness; which, when infused into curricula make it more culturally responsive (Waghid, 2014; Singh, 2015; Seehawer, 2018; Maluleka, 2020). Importantly, the value of diversity and respect for diverse viewpoints is also emphasised in *ubuntu* as, “people cannot refute the humanity [views] of others without repudiating their own humanity” (Maluleka, 2020:143). Thus, inherent in *ubuntu* is an acceptance of diversity. And, if the cohort is diverse, then so too is the knowledge and sense of being which is derived from the eclectic community of practice. Hence, in a truly Africanised curricula, other viewpoints are not marginalised (Patel *et al.*, 2024). In this respect, *ubuntu* notably aligns with the postmodern perspective of “a community understanding of truth” (Grenz, 1996:20). Based on these values, West (2014) consequently argues that approaches which integrate the moral ideal of *ubuntu*, seek to be socially just. In the South African context (with its persisting legacies of division), the introduction of *ubuntu* as a moral guide for Africanising curricula – with its prioritization of mutual respect and understanding– may valuably palliate current epistemic tensions.

As previously evidenced, there is a corpus of research which discusses the reasons, challenges and suggested directions for the Africanisation of university curricula. By in large, this research stems from the likes of philosophers and educationalists, located in the humanities and social sciences faculties (see for example: Maake, 1997; Horsthemke, 2004; van Wyk & Higgs, 2004; Waghid, 2004; Nkoane, 2006; Louw, 2010; Prinsloo, 2010; Letsekha, 2013; Msila, 2014; Le Grange, 2016; Ramoupi & Ntongwe, 2016; Sebola & Mogoboya, 2020). In addition, more has been written in this respect regarding school curricula than tertiary curricula (Msila & Gumbo,

2016; Cross & Ndofirepi, 2017; Knight, 2018). Moreover, despite the preceding motivations for the importance of Africanisation, there has been resistance to it from tertiary science disciplines, as the aforementioned ‘universalising truth’ of positivist outlooks, can remain entrenched in the university and its academics (Kuntz, 2012; Msila, 2014; Nyamapfene & Ndofirepi, 2017; Kolawole, 2019; Hungwe & Mkhize, 2022). Correspondingly, research on approaches to Africanising ‘discipline-specific’ tertiary curricula in South Africa is limited – the few examples include: mathematics (Seepe, 2000); regional geography (Fox, 2005); English studies (Cornwell, 2006); history (Brizuela-García, 2006); education (Botha, 2007; Biccard & Meeran, 2024); comparative law (Fombad, 2013); theology (Naidoo, 2016); philosophy (Etieyibo, 2016; Ramose, 2016); economics (Muller, 2017); and business analysis (Eybers *et al.*, 2025). Moreover, while Africanisation is distinct from decolonisation, it nevertheless bears mentioning that, in this related research domain too, there is similarly a shortage of approaches decolonising tertiary curricula in specific natural science disciplines (see review by Shahjahan *et al.*, 2021). Importantly, in conducting this review of 207 available articles on the subject, Shahjahan *et al.* (2021:73) conclude that “while there are similarities within the literature, ultimately the meanings, actualizations, and challenges [...] are contextual”. Considering the foregoing, there is a paucity of research focused on the transformation process of Africanising tertiary science curricula – and particularly, in the context of tertiary soil science curricula in South Africa.

2.6 Conclusion

Despite the absence of a guiding transformation process, various authors have suggested certain measures that contribute to Africanising curricula. Sebola and Mogoboya (2020:243) argue that “the Africanisation project has two sides”: firstly, unmasking and critiquing the dominating euro-centricity within a discipline’s canon; and secondly, reimagining Afro-centred knowledge production in the field. Thus, a transformative approach, would need to interrogate and disassemble the power imbalances, social hierarchies, and ideological norms that currently pervade a canon; followed by starting to develop more inclusive and epistemically diverse curricula (Lockett & Shay, 2017). Other authors variously ask nuanced questions in this respect, for example: what are sources of epistemological beliefs in the canon and the curriculum? What are the foundational and implicit propositions? To what and whose ends are the practical applications and consequences? What is not valued and is thus marginalised? What are the discipline’s blind spots? What process-based steps can be taken? (Nyamnjoh,

2012; Ndofirepi, 2014; Meyiwa *et al.*, 2020; Swartz *et al.*, 2020). Importantly, in exposing loci of epistemic domination, Le Grange (2018:9) further suggests critically asking the following questions of a discipline's epistemics: "[(1)] Who controls the field internationally and in South Africa? [(2)] Who controls the institutions and organisations of the field? [(3)] Who produces knowledge in and of the field (including its histories)?" Unmasking dominant, yet inherent, western paradigms in academic disciplines is thus a decolonial step in the Africanisation project (Naidoo, 2016).

This chapter has outlined the epistemic injustice of western science's universalising epistemic and argued for the moral, epistemic, and practical reasons to Africanise curricula in South African universities. Building upon this, the next two chapters surface, discuss and analyse examples of epistemic and other biases in the discipline of soil science. Accordingly, Chapter 3 analyses such biases in a soil science textbook, while Chapter 4 similarly analyses and critiques the canon and disciplinary structures of WSS.

CHAPTER 3: TEXTBOOKS AND EPISTEMIC MARGINALISATION: A SOIL SCIENCE CASE STUDY

3.1. Introduction

As informed by the foregoing Africanisation literature, this chapter¹² seeks to bring to light (otherwise uninterrogated) euro-centric bias in soil science, particularly in an undergraduate textbook. It contributes to the arguments presented in the thesis, as any contextually sensitive teaching, and any move to Africanise a curriculum, should consider the issue of textbooks. Thus, from the perspective of the need to Africanise the curriculum, this research represents an attempt to interrogate one undergraduate soil science textbook in order to determine its usefulness with respect to Africanisation. The textbook in question, Ashman and Puri's (2002), *Essential Soil Science* has been a prescribed or recommended as undergraduate soil science textbook at some South African universities for a number of years, and remains in print. In this regard, the chapter firstly outlines the western epistemological biases of textbooks. It then considers the need to Africanise textbooks, in the face of the dominance of textbooks produced in the global North. The relevant principles for the analysis of textbooks are then briefly outlined. The results of the analysis are presented and then discussed. The consequent necessity for African academics to interrogate their textbooks for bias concludes the chapter.

3.2 Textbooks as Epistemological and Value-Laden Pedagogy

The importation (or imposition, depending on authors' perspectives) into Africa of euro-centric education models and curricula, is well acknowledged in the literature (Semali & Stambach, 1997; Lenoir & Jean, 2012). In some cases, such models and curricula are brought to Africa by foreign 'experts' or aid organisations, but in many other cases, Africans themselves impose this type of curricula on their countries. Yet euro-centric education models and curricula are disconnected from the African context. Thus, such imported models will seldom produce the kind of educated person Africa needs, as the curricula are not 'fit for purpose' (Lenoir & Jean, 2012). This situation has continued for decades despite research indicating that the needs of African students, and African societies, are often at odds with 'western curricula' (Ukwuoma, 2016). Studies in, *inter alia*, Tanzania (Semali & Stambach, 1997), the United States and

¹² This chapter is an adapted version of the published peer-reviewed DHET accredited article: Milaras, M. & McKay, T.J.M. (2019) Marginalisation of Global South Epistemics: The Case of a Soil Science Textbook. *SOTL in the South*. 3(2): 31-48. DOI: 10.36615/sotls.v3i2.93.

Canada (Kirkness & Barnhardt, 1991; Mack *et al.*, 2012), Malawi (Phiri, 2008), South Africa (Letsekha *et al.*, 2014; Masemula, 2013), and Zambia (Zinyeka, 2014) found that the integration of IK into science curricula can improve student performance as it makes the content relatable and familiar.

If this is not done, then *status quo* western epistemologies are effectively imposed upon African students by the means of euro-centric teaching materials. More insidiously and as famously argued by Paulo Freire (1970:47):

[e]very prescription represents the imposition of one individual's choice upon another, transforming the consciousness of the person prescribed to into one that conforms with the prescriber's consciousness. Thus, the behaviour [or knowledge] of the oppressed is a prescribed behaviour [or knowledge], following as it does the guidelines of the oppressor.

Moreover, the imposition of euro-centric curricula actively discourages the production of relevant African teaching and learning resources such as textbooks (Katonga, 2017). Devetak and Vogrinc (2013:4) support this argument by highlighting that “uniformed ideas presented in a textbook could affect students’ learning in a direct or indirect way”. Therefore, an important vehicle for the imposition of certain discourses is the textbook (Wang, 1998; Devetak & Vogrinc, 2013; Svendsen, 2015). Ivić *et al.* (2013:28) for example state:

[t]extbooks, by default, play a major role in the life of every person in the early stages of his or her development. [And that] this is the crucial period for the acquisition of knowledge and skills and the development of reasoning, personality traits, points of view, values, needs and habits.

Thus, the impact of textbooks on students’ and cultures’ epistemics should not be underestimated.

Accordingly, textbooks are not therefore, simplistic ‘containers’ of discipline-specific scientific facts, but must be acknowledged as cultural artefacts (Venezky, 1992; Foster, 2011). A cultural artefact has been defined by Wartofsky (1979) as a manufactured object or article whereby the political, ideological, or worldview of the author or producer – all of which are located within a particular cultural milieu and age – are embedded in the object (in this case, the textbook). All too often, these embedded biases woven into textbooks remain unnoticed, uninterrogated, and unacknowledged. For example, Lenoir and Jean (2012), indicate how textbooks in five French-speaking African countries are either entirely devoid of local contextualisation (so much so that they could be mistaken for textbooks meant for students

living in France), or only add a local context in a shallow manner. Such culturally mismatched didactic material can lead to learner alienation and significant academic underperformance (Cobern & Aikenhead, 1997, Stein *et al.*, 2001). Nevertheless, many education systems rely on textbooks as essential educator support tools without necessarily realising (often for decades) that a particular worldview is being perpetuated (National Education Union, 2016). In particular, the role that the content of science textbooks, and the commodification thereof, play in foregrounding certain epistemological and geographical narratives (while marginalising others) remains unchallenged. Love (2012:133) succinctly argues that:

[s]cience, as a culturally constructed concept described in science textbooks, is created through the cultural values of capitalism, technocentrism, colonization, and globalization because those are the ideologies that supported by the dominant elites and further supported with hegemonic thinking by the disempowered masses.

Sutherland and Swayze (2012) further argues that an important component in fostering deep learning is the contextualisation of science education within local contexts. Without contextually-sensitive learning materials, students could be both alienated from the discipline and misconceptions could be fostered (Asabere-Ameyaw *et al.*, 2012). In this regard, prescribing a textbook without taking its worldview and context into account is poor pedagogical practice. Importantly, in South Africa, part of the #RhodesMustFall and #FeesMustFall dissent highlighted the mismatch between the locale and curriculum, with students demanding a decolonised and Africanised curriculum (Le Grange, 2016). Thus, if academics are to engage with such calls, then the textbooks that are in use, or those that will be prescribed/recommended, must be critically interrogated from perspectives of Africanisation.

3.3 An African Philosophy of Education and the Africanisation of Curricula

Notwithstanding the then Minister of Higher Education Blade Nzimande's public call to Africanise university curricula in his address at the Higher Education Summit of October 2015, the topic has been extensively discussed in academic research since 1994 (Moulder, 1995; Makgoba, 1997; van Wyk & Higgs, 2004; Waghid, 2004; Cornwell, 2006; Ntumi & Priebe, 2010; Letsekha, 2013; Singh, 2015; Le Grange, 2016; Luckett *et al.*, 2019). The departure point for almost all of this literature is the acknowledgement that indigenous ways of knowing in South Africa (and elsewhere) were historically denigrated by colonial powers, and that the legacy of this epistemic violence remains. That is to say, African ways of knowing were

dismissed and relegated in relation to western knowledge. Over 100's of years of colonialism, this promoted an 'aspiration' in Africans to 'westernise', and the self-negation of IK – such that these knowledge systems were diminished from one generation to the next. This propagation of euro-centric knowledge is exemplified in university curricula (De Lissovoy, 2010; Mutekwe, 2015; Heleta, 2016). The response to this euro-centric legacy, both in terms of South African university student protests and academic research and critique, has been to insist that tertiary curricula be Africanised or decolonised (Le Grange, 2016).

Numerous authors have thus concerned themselves with an African 'philosophy' of education (see Higgs, 2003; Le Grange, 2004; van Wyk & Higgs, 2004; Waghid, 2014). Higgs (2003) and van Wyk and Higgs (2004) for instance, put forward an African philosophy of education which values diversity, respects lived experience, and questions western universal knowledge. Such a philosophy, they argue, is built on an African identity that has reclaimed the interwoven values of communalism, *ubuntu*¹³, and humanism. By using these philosophical foundations as departure points, African universities and their curricula can consequently be transformed. However, Parker (2003) critiques Higgs' (2003) argument as being overly simplistic and decontextualized. Le Grange (2004:146) subsequently, and in detail, critiques both Parker (2003) and Higgs' (2003) articles as "fundamentally flawed"; while Waghid (2014) defends a communitarian view of an African philosophy of education, and Nakusera (2004) argues that transformation can stem from critical storytelling in indigenous languages. Thus, even though implementing an African philosophy of education may lead to the Africanisation of curricula and consequently their textbooks, there is no outright agreement as to what comprises such a philosophy (Horsthemke & Enslin, 2009). It must be added that, most do agree on the point that a pluralism of epistemologies (western, indigenous, and otherwise) is required in the process of Africanising curricula, to preclude essentialising a curriculum. Higgs (2016:95) for example advocates an 'African Epistemic', which, through "creative integration", gives IKS equal validity without excluding western knowledge systems, if we are to address local, and even global, problems effectively. Ndofirepi and Cross (2014:297) support this, and succinctly state that: "[t]here is a need to strike an honest balance between the African and the non-African in the curriculum".

¹³ Ubuntu is defined by Le Grange (2011:69) as being "aware of one's own being, but also of one's duties towards one's neighbour."

In advancing the Africanisation of curricula, the critical interrogation of western science epistemics in soil science, is however mostly unexplored, including in textbooks. In this regard, this chapter contributes to the body of knowledge by interrogating the degree of Africanisation of an undergraduate soil science textbook used by some South African institutions of higher education. To clarify an Africanised textbook is defined as: one that is appropriately conceptualised, contextualised, and tailored for students operating from, and within, an African context. Thus, Africa (as part of a globalised world), is axiomatically affirmed as the focus of such a textbook, while balancing and gainfully including western and other epistemologies, thus averting an intolerant Afrocentrism (see Letsekha, 2013). As evidenced in Chapter 2, there is nonetheless little in the way of existing literature which interrogates the Africanisation of discipline-specific sciences (and their textbooks). One of the reasons for this may be the commercialisation and skewed production of textbooks in the global North. Thus, it is to this topic which the chapter now turns.

3.4 Commodification of Knowledge: The Global North and Textbook Production

Ivić *et al.* (2013) posit that textbooks are far more likely to sell than other genres of printed books, making the writing, publishing, and distribution of textbooks a magnet for commercial enterprises. Pre-1970 was an era of many small, niche, academic publishing houses, university presses, and disciplinary societies (who published academic textbooks and journals). Circa 1970 this ended and academic publishing became “big business” (Hagner, 2018:2). This occurred through a process of agglomeration such that only a few, very large, for-profit publishing houses now remain (Hagner, 2018). What is more, most of these large publishing houses are located in the global North, namely: Elsevier and Wolters Kluwer (both of The Netherlands), Sage and Wiley-Blackwell (both of the United States of America), Taylor & Francis (England), and Springer-Verlag (Germany). These ‘Big Six’ control the lion’s share of academic publishing (Larivière *et al.*, 2015; Jandrić & Hayes, 2019). Due to extremely limited competition and a ‘captive’ market, these publishers are essentially an oligopoly: able to dictate pricing, as well as strongly influence who, and what, gets to be published. It is a lucrative business, with Elsevier, for example, reporting profit margins in the order of 37% circa 2012 (Forgues & Liarte, 2013; Logan, 2017). In such a scenario, many voices are not heard, and more power accrues to these publishing houses over time (Paasi, 2005).

Of course, corporatisation also results in the aggressive marketing of textbooks to educational institutions and educators by the academic publishing houses. In this regard, a ‘general’ type of textbook that can be a ‘bestseller’ across the globe, is the best option for a publishing house to punt. Generic textbooks that can be sold worldwide bring greater investment returns than multiple books each designed for small niche markets. Some markets however are dominant, so textbooks tend to be written to meet the demands of the dominant market. In the case of scientific publications this is often the English-speaking world, consisting of the United Kingdom (UK), its former colonies, and the United States of America (USA) (Paasi, 2013). In such a situation, any author who does not write in a way that maintains the epistemological *status quo* in terms of a western worldview and western thought is unlikely to be commissioned to write for the publishing house; and even if they were, such books are unlikely to be easily sold (Love, 2012). Thus African and/or IK perspectives in such textbooks are often lacking (Nichols, 2012).

The corporatisation of the academic textbook market also poses an additional problem for the global South, where universities (their libraries, academics, and presses) are usually underfunded (Joseph, 2015). This means, on the one hand, their academics and university presses do not have the human and financial resources to develop their own textbooks; while on the other hand, the limited resources they do have must be used to acquire very expensive books from the global North. Thus, there is a duplicity in which textbooks are written in, and for, the global North, yet are also sold in the global South for profit, while simultaneously marginalising subaltern knowledge systems. South Africa, with one of the most well-funded higher education sectors in Africa highlights this problem.

Le Roux *et al.* (2024:30) point out that South African academic “books compete against well-resourced international publishers and textbooks”. The most recent report of The Publishers Association of South Africa (PASA) for the years 2022-2023, indicate that only 47 scholarly books (mostly in the social sciences and humanities) were published in the country (Le Roux *et al.*, 2024). This represents a decline to a mere six percent of South Africa’s total publishing output (see Figure 3.1). Furthermore, it appears that the publication of ‘locally-tailored’ scholarly books in the STEM (science, technology, engineering, and mathematics) fields is

extremely difficult. Moreover, low volumes mean limited employment opportunities, with academic publishers reporting the employment of about 40 people nationally (Joseph, 2015).

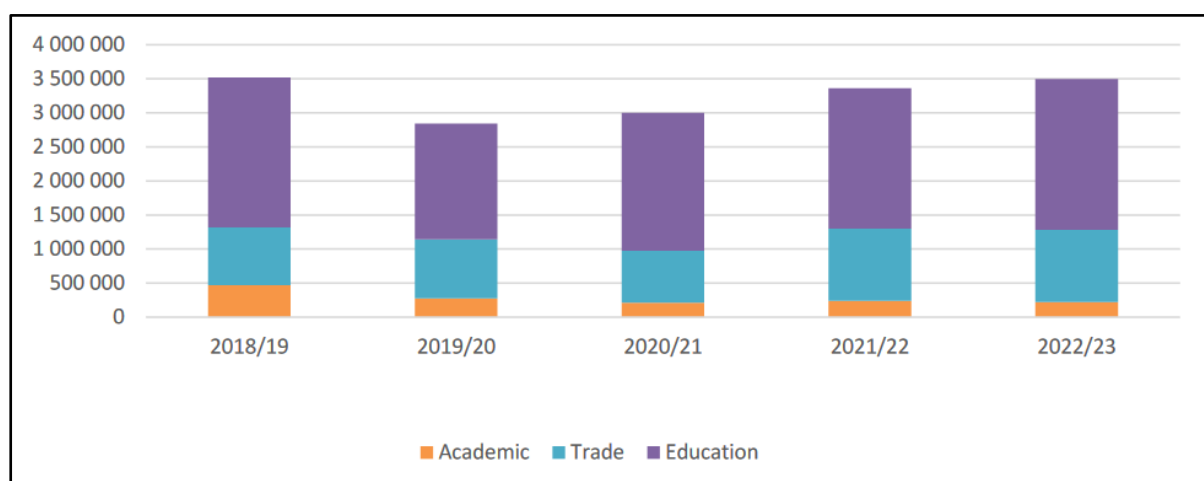


Figure 3.1: South African publishing industry revenue in ZAR, 2018-2023 (Le Roux *et al.*, 2024).

Similarly, Mather (2007) and Joseph (2015) both note that South African academic research outputs in academic journals, have become increasingly published by global North publishing houses. That is, South African academics, for various reasons, such as institutional pressure and National Research Foundation (NRF) rating criteria, are electing to ‘publish internationally’ in ‘prestige journals’, shunning publishing bodies located in the global South in the process (Mather & Ramutsindela, 2007; Visser, 2007). This, in the long-term, aggravates the situation in which local academics working in publically funded South African research institutions and universities, can no longer access publications of their own labour (despite the research being funded by the South African State), as these publications reside behind the high paywalls of international publishing giants (Forgues & Liarte, 2013). This contributes to widening the knowledge gap on issues concerning the global South, reinforces the hegemony of global North academia, marginalises IK and non-western learners, and results in a flow of money from the global South to the global North (Ndofirepi & Cross, 2014). This could be regarded as a form of academic colonialism.

3.5 Soil Science Textbook Analysis

There are multiple ways to evaluate textbooks (Steinley, 1987; Richards, 2001; Stein *et al.*, 2001). For this study, the methodology was informed by the work of Svendsen (2015). In this regard, Svendsen (2015) indicates that there are three broad categories of textbook analysis research, namely: (1) process, (2) application, and (3) product. That is to say, analysis either focuses on (1) the production and distribution of textbooks, or (2) how textbooks are used by teachers and learners, or (3) an analysis of the content of textbooks. This research falls into the third category. In addition, there are innumerable frameworks that have been developed to undertake textbook content analysis, either qualitative or quantitative in nature. Wang (1998) for example, tabulates 29 methods. Quantitative approaches tend to measure frequencies or volume of text allocated to certain concepts, in order to ascertain where the emphasis of a textbook lies. Such approaches use strict deductive coding frameworks to be as objective, reproducible, and comparable as possible. Nevertheless, the selection of a quantitative coding framework is itself a subjective decision (although this tacit subjectivity is usually obscured by the quantitative framework's 'objectivity'). Alternatively, qualitative approaches seek to interpret and understand the nuances and meanings of messages and values that lie implicit within the text (Pingel, 2009). For example, posing questions such as: (1) is one perspective/form of knowledge/location favoured over others? and, (2) why is this likely to be the case? As such, qualitative analysis cannot follow the structure of quantitative methods, and instead relies on the researcher's values and understanding of the text. These should be made explicitly transparent at the start, and thus embrace their subjective perspective. Qualitative analysis can, therefore, investigate hermeneutic questions of the text. Moreover, qualitative analysis can be deductive or inductive. A deductive approach, in an *a priori* manner, imposes a conceptual frame by which to interpret the text; while an inductive approach, in an *a posteriori* manner, examines the text until common identifiable themes emerge (Berg, 2001; Pingel, 2009). As it is, therefore evident, those quantitative and qualitative approaches have advantages and disadvantages – and for this reason, they can complement each other.

The research presented here, an analysis of an undergraduate soil science textbook, is of limited scope, and is quantitatively analysed in a deductive manner. The analysis of a single textbook is not intended to be representative of soil science curricula, but rather is a case study indicative of the biases germane to such curriculum resources. The analysis was based on *a priori* manifest content analysis of representations of geographical location in the text (Bengtsson,

2016). In the light of the work of Sutherland and Swayze (2012) and Asabere-Ameyaw *et al.* (2012), the book was analysed for its diversity of geographies and contexts. Importantly, it is acknowledged that analysing only geographic representations is not a definitive analysis of the degree of Africanisation. However, it is argued here that the use of geographical specific examples is a vital *indicator* of Africanisation.

3.5.1 Results

The results of an *a priori* manifest quantitative content analysis (following Bengtsson, 2016) are presented in Table 1. In particular, Table 1 presents the geographic locus of examples (of various soil characteristics, classifications, issues, etc.) used in the textbook under analysis. This was done to determine how geographically balanced – between the global North and global South – the examples are. The definition of global North and global South follows that of Blicharska *et al.* (2017), whereby the World Bank’s classification of low, lower-middle, and upper-middle income countries comprise the global South, while high-income countries constitute the global North (World Bank, 2019). This ‘economic power’ definition, with consideration for country specific examples broadly defines Africa, Asia, and South America as the global South; with Europe, North America, and Australia classified as the global North. The first exception to this is Israel, which technically lies in the Middle East, but is high-income and so part of the global North. The second exception is Australia, which geographically lies in the south, but is also a high-income country. These two minor exceptions have been taken into account in Table 3.1 and subsequent calculations.

Table 3.1: Quantitative analysis of the locality referenced in examples used in the textbook (Milaras & McKay, 2019).

Global North Continent/Country	Count	Global South Continent/Country	Count
Australia Total	2	Africa Total	8
Australia	2	Egypt	2
Europe	115	Ethiopia	1
Denmark	1	Kenya	1
France	4	Sudan	1
Germany	1	Africa as continent	3
Italy	3	Asia Total	16
Israel	1	China	1
Norway	1	India	1
Switzerland	1	Iraq	3
The Netherlands	3	Pakistan	1
United Kingdom	90	Russia	7
Europe as continent	10	Vietnam	1
North America Total	44	Asia as continent	2
Canada	3	South America Total	2
United States of America	40	South America as continent	2
North America as continent	1		
Global North Total	161	Global South Total	26
Grand Total: 187			

In total, 187 examples with geographical contexts are given in the textbook. The majority (169) refer to specific countries, while some examples (18) refer to a continent. These examples are spread across 185 pages, or 1.01 examples per page. Of the 187, some 86% refer to localities of the global North, where Europe dominates, followed by North America and Australia respectively. In total, examples from the United Kingdom (UK) and the United States of America (USA), comprise 81% of all global North examples (56% and 25% respectively), with Australia and Israel constituting the remaining 19%. Consequently, 70% of all examples in the textbook stem from either the UK or USA. Thus, there is a strong didactic narrative focused on the UK. By way of illustration, the examples range from: (1) naming the Englishman John Bennet Lawes as responsible for the first agricultural trials in 1843 (p114); (2) indicating the irrigation rate for potatoes in the UK (p126); (3) quantifying the UK lime deficit (p134); and (4) citing numerous guidelines from the UK Ministry of Agriculture, Fisheries and Food (MAFF) (such as recommended fertilizer application rates, soil nitrogen supply, phosphorous

and potassium targets, and manuring limits (see p139 – 142, p143, p148, p149). An emphasis so great may indicate that the textbook was written for an UK audience. Second to this, is the prominence of examples from the USA (21%). Some specific USA examples include tables on irrigation water classification (p127); liming rates (p137); and plant tissue analysis (p143).

Overall, in terms of sheer number of examples, both the UK and USA are extreme outliers. When compared to population served, however, the situation is worse. In terms of population for 2002 (when the book was published), the population of the UK was roughly 60 million, which equates to one mention to 67 000 people. For the USA, with 288 million people in 2002, this represents one mention to 7.2 million people. This is a huge over-representation when compared to India (with 1 billion people in 2002) but only one mention in total, and China (with 1.3 billion people in 2002) with also only one mention. Thus, in terms of population served, the USA and UK are over served and the two most populous global South nations are severely underserved¹⁴. In contrast to the dominant global North propaedeutic, examples from the global South comprise only 14% of all examples in the textbook. Of the global South examples, some 61% stem from Asia, 31% from Africa and 8% from South America. Africa, a continent of one billion people, comprises a mere 4% of all the locations mentioned. Examples are also limited to crop irrigation for Egypt and Sudan (p123), and erosion in Ethiopia and Kenya (p179 & 179). In terms of comparison by population size for 2002, countries in the global North representing 784 million people garner 157 mentions, compared to the global South, with a total population size of 2.7 billion but only 12 mentions. The implications of these results for an Africanised soil science pedagogy in an African context will subsequently be discussed.

¹⁴ See <https://www.census.gov/prod/2004pubs/wp-02.pdf> [Accessed 27 March 2019].

3.5.2 Discussion

The distinction that ‘western’ examples are given, and the prominence of the UK and USA in particular, is at odds with what the publisher explicitly states about their intentions for the textbook. According to Wiley’s (2025) promotional webpage for the textbook¹⁵:

This textbook is aimed at the majority of students, who need to quickly acquire a concise overview of soil science. [...] This short informative guide, will be particularly useful for students who do not possess a traditional scientific background, such as those studying geography, environment science, ecology and agriculture. [It is the] only textbook to cater for introductory courses in soil science; [...] provides an affordable concise overview of soil science; [and] no scientific background [is] assumed.

In this regard, the publisher appears to claim the book is a ‘global’ soil science textbook that can be used in *all* contexts by *all* soil science undergraduate students. It seems the publishers synonymise ‘global’ with ‘western’. The analysis provided here indicates that the book was written for students residing in the UK, Europe, and the USA – that is, the global North. Thus, the authors had a specific audience in mind, one that is not actually global but western. Figure 3.2 further illustrates the skewness of the geographic distribution of the examples, illustrating that the textbook lacks geographic diversity and sensitivity. The book is, thus, euro-centric, and propounds an almost entirely western epistemic, with seven-eighths of examples specifically located in the global North. The few non-western examples, can at best, be described as tokenism (Lenoir & Jean, 2012).

This is further illustrated by the pricing of the book. In 2025, the e-book has a list price of 79.00 USD and the paperback 98.95 USD (1 472 ZAR and 1844 ZAR respectively¹⁶). Thus, the cost of this small 198 page textbook places it out of the purchasing range for most African students (Le Grange, 2016). This is another indicator that the so-called ‘global’ textbook is produced for markets in the global North, which have greater purchasing power than those of the global South (Love, 2012; Nichols, 2012; Paasi, 2013). Moreover, a basic core-periphery model within the knowledge economy is exemplified, whereby: the global North is the knowledge

¹⁵ <https://www.wiley.com/en-us/Essential+Soil+Science%3A+A+Clear+and+Concise+Introduction+to+Soil+Science-p-9780632048854>
[Accessed 5 February 2025]

¹⁶ At an exchange rate of 18.63 ZAR to 1 USD in February 2025.

producer, the global South is the knowledge consumer, with its own knowledge production accordingly marginalised, and from whom profits are extracted (Mather, 2007; Joseph, 2015).

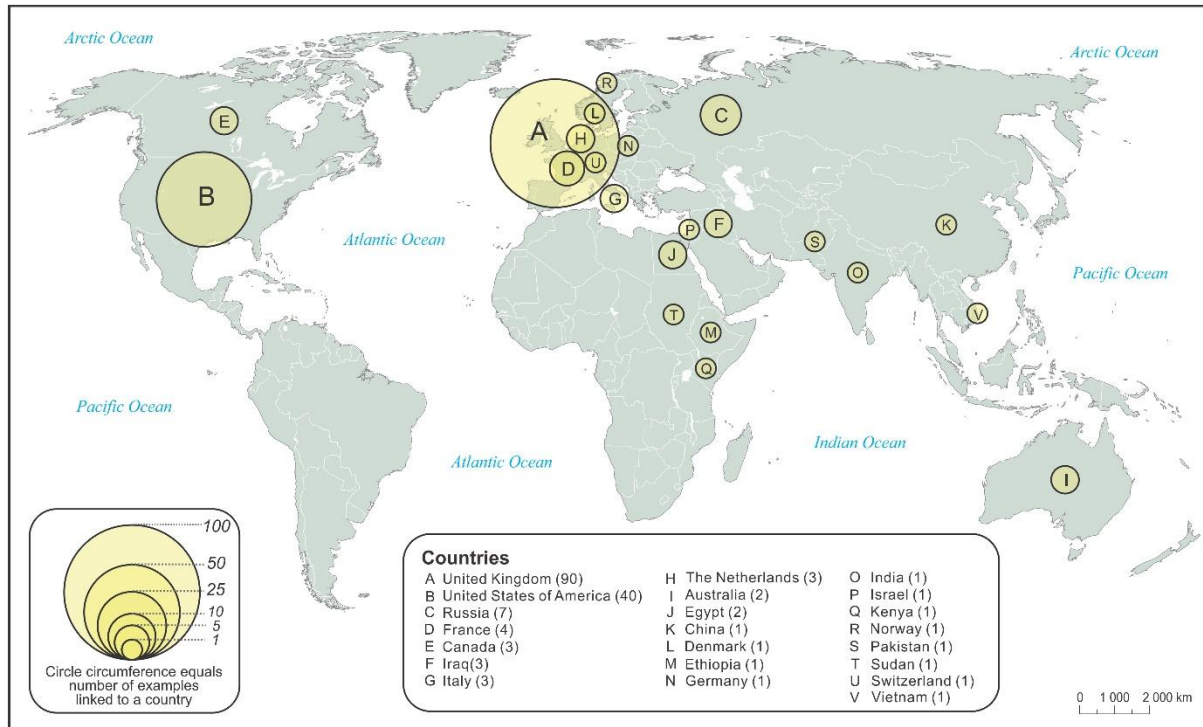


Figure 3.2: Proportional circle map indicating both the skewed number and location of geographic examples provided in the textbook (note: data are for countries only, not continents) (Source: Milaras & McKay, 2019).

To this end, Van Wyk's (2002) argument that STEM epistemologies maintain a culture of power (and marginalise IKS) by assuming that all scientific didactics, and consequently, students, as well as the pedagogies required, are homogenous, is affirmed. Such heavily westernised course content creates epistemological hurdles for African university students due to the mismatch between the content of the book, and their culture and lived experience (Sennet *et al.*, 2003). Learning under such circumstances is a challenge. If, for example, learning takes place in the 'zone of proximal development', where students cognitively move from the known to the unknown, African students will struggle to learn, as all their experiences (and the context they need to operate in once qualified as soil scientists), are unacknowledged in the book (Vygotsky, 1978). Thus, the book is likely to generate an experience of alienation. It is very likely that students residing in the global South will underperform under such circumstances (Cobern & Aikenhead, 1997). Prescribing such a book may result in students struggling to

reconcile the dominant western epistemic that it purports and their personal and geographical context.

In such circumstances, the global North didactic is undermining the ability of African students to become professional African soil scientists. In particular, the book incorrectly projects the notion that much of soil science is universal or geographically transferable, creating misconceptions pertaining to soil science. For example, students using this book may undermine African farmers and African agricultural extension agents as research shows that significant errors occur when attempting to generalise models for crop yield, fertilizer concentrations, soil carbon, nitrogen leaching, and drainage across all contexts due to the incorrect aggregation of climate and soil data (Tabor, 1992; Hoffmann *et al.*, 2016; Coucheney *et al.*, 2018). Thus, decisions based on generalised and western models may be inappropriate for an African environment, misleading farmers and possibly causing crop and financial losses.

3.6 Conclusion

While this research presents a small-scale empirical case study of one soil science textbook, the results indicate that despite the marketing rhetoric, the book has been written with one particular geographical setting (and market) in mind. The claim that it is a ‘generic’ undergraduate soil science textbook is not supported by the findings of this research. Prescribing this book in a Southern African setting, with radically different geographical conditions, is unlikely to assist African students to become competent local soil scientists. What is more, from a geographical perspective, the book may well alienate African students and undermine their efficacy in African soil science, the context in which most will live and work. Importantly then, if the soil science curriculum is to be Africanised, research needs to be conducted to determine how textbooks can support the call to Africanise curricula. In this regard, genuine Africanisation of the curriculum may not be possible without disrupting the *status quo* of western hegemonic textbook production. Notably, if the epistemological imperialism of the global North is to be addressed, it is important that local African publishers are supported by the State and public universities to produce Africanised textbooks (especially ones in STEM).

This chapter has critically analysed and found biased euro-centric epistemics inherent in a soil science textbook used in African universities. As this research's focus is the development an Africanising process for a soil science curriculum. Accordingly, this chapter concludes that pedagogical aids, such as textbooks, should also be Africanised. This study now turns to a more in-depth critical analysis of academic discipline of WSS, its epistemics, cannon, and disciplinary structures.

CHAPTER 4: WESTERN SOIL SCIENCE AND LOCAL SOIL KNOWLEDGES

4.1 Introduction

This chapter discusses the academic literature on WSS and LSKs. The review of this literature begins by tracing the pre-modern history and importance of soil knowledges. It then provides an overview of modern, westernised soil science, by way of its: origins, evolution, epistemic structure, disciplinary importance, and future directions. Then, epistemic and canonical – as well as its systemic and institutional – biases are surfaced and critically discussed. Subsequently, alternative local epistemologies of soil knowledge are presented. The chapter concludes that in fostering a meaningful engagement between WSS and LSK, modern understandings of soils can significantly be expanded. Tertiary soil science curricula are proposed as an effective site for this Africanising transformation.

4.2 Early Agricultural Soil Knowledge and Sedentary Civilization

It is generally agreed that the major shift from hunter-gatherer nomadism to sedentary civilization – termed the Neolithic Revolution – occurred between approximately 11 000 and 8 000 B.P. (Before Present). The cultivation of crops required people to remain in one place and tend to their fields throughout the year. When these settlements produced a surplus, trade in agricultural products could occur. Crop cultivation can also give rise to population growth as food is more readily available. Over time, there was a diversification of skills, the rise of economic institutions, political classes, and other antecedents of modern settled urban civilisation (Melko, 2008; Fuller & Stevens, 2019). Importantly, intimate and technical LSK was required for the success of this agricultural transition (Gong *et al.*, 2003; McNeill & Winiwarter, 2004). Notably, Vavilov’s well-known ‘Centres of Origin’ (or ‘Centres of Diversity’) theory – which distinguishes the Neolithic birthplaces of crop domestication – acknowledges LSK as integral to this revolutionary development (Kotlyakov & Komarova, 2007; Hummer & Hancock, 2015; Cohen & Loskutov, 2016; Khoury *et al.*, 2016). Highlighting the enormity of this shift, Patzel (2009:207) cites one of the founders of modern soil science, Fallou (1862:46): “Our culture and civilisation, everything we have, we owe solely to the bond, which man had entered with his Mother Earth. Because it was agriculture, which made man become himself.” In the same vein, Descola (2009:xv) contend that “let’s not forget that in

Latin ‘soil’ (humus) and ‘human’ (homo) come from the same Indo-european root meaning ‘earth’.”

Over the course of time, humans became more and more settled. Developing and practicing local agronomic knowledge provided distinct advantages to proto-settlers over hunter gatherers. Diamond and Bellwood (2003) enumerate some of these advantages. Firstly, increased food production supports more people at higher densities. Secondly, stored food surpluses freed up labour and enabled cultural and technological diversification. Thirdly, while infectious diseases could proliferate in crowded sedentary populations, the survivors developed immunities that hunter-gathers did not have. Thus through displacement, disease and diffusion, existing nomadic hunter gather populations were dominated and supplanted by settled, agricultural ones. Figure 4.1 illustrates this geographical process. Floodplains came to be preferred, due to access to both water and food, and they evolved into agricultural hearths due to their nutrient-rich soils of alluvial silt. For example, the Mesopotamian civilizations settled between the Tigris and Euphrates Rivers; the Ancient Egyptians settled in the Nile River delta; Indus valley civilizations relied on the Ganges River; and early agriculture in China centred on the Yellow River floodplain (Brevik, 2005; Lag *et al.*, 2008; Dotterweich, 2013).

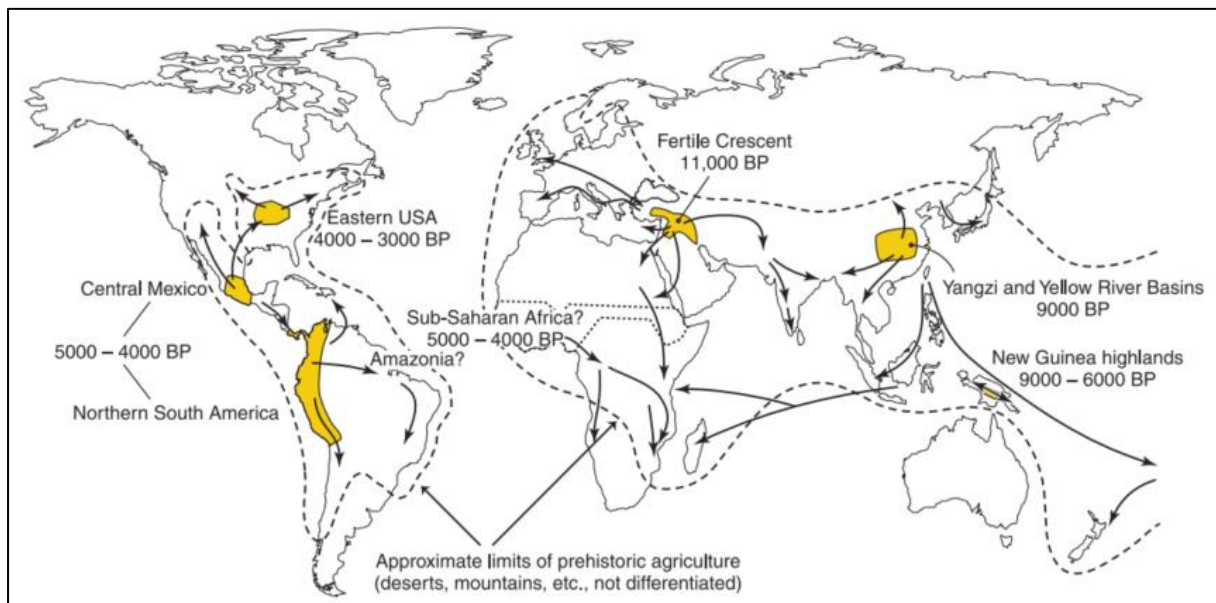


Figure 4.1: Archaeological map of agricultural homelands and spreads of Neolithic/Formative cultures, with approximate radiocarbon dates (Diamond & Bellwood, 2003:597).

Due to their sedentary nature, it was imperative to their survival for these agricultural communities to develop LSK. Thus, it is argued here that the rise of indigenous soil knowledge was part and parcel of this first Neolithic agronomic revolution and has accordingly remained very important throughout humanity's settled history (Barrera-Bassols & Zinck, 2000; Lal, 2007; Wu *et al.*, 2019). Moreover, estimates indicate that more than 95% of food production worldwide is reliant on soil (van Zijl, 2019; Kraamwinkel *et al.*, 2021). Figure 4.2 accordingly illustrates how increases in human population growth have been contemporaneous to historical agricultural advancements (Trolard *et al.*, 2019). This strongly suggests a relationship between the rise of human cultures (and the magnitude of their populations) with that of the development of soil knowledge (Richerson *et al.*, 1995). The importance of LSK throughout human history is thus not overstated.

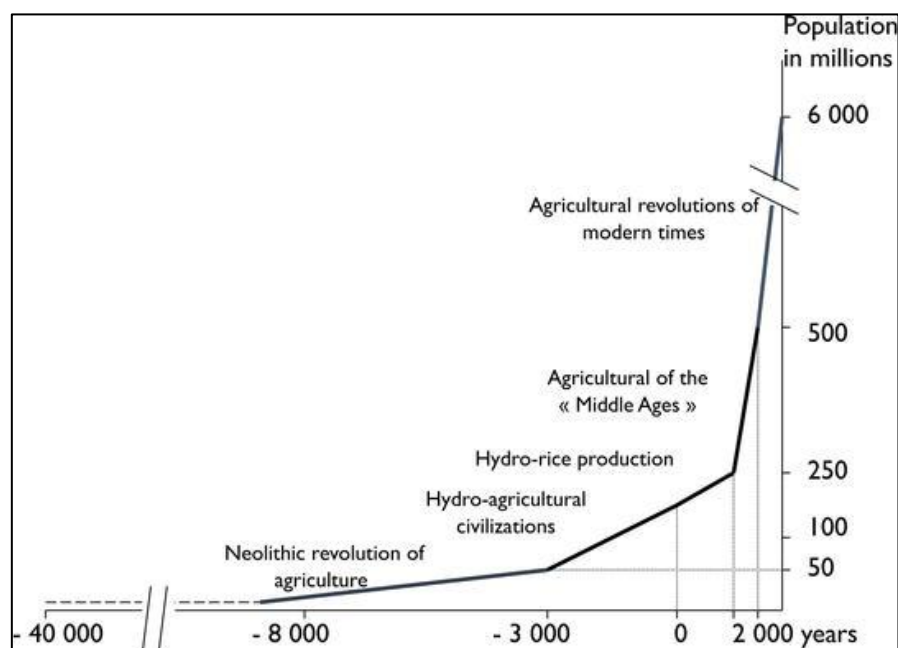


Figure 4.2: Graphical representation of the progressive development of agrarian systems as enablers of human population growth (Trolard *et al.*, 2019:2).

It can thus be appreciated that LSK was of primary importance to the Neolithic revolution of agriculture and the establishment of sedentary civilizations. Accordingly, it was early farmers who recognised the importance of LSK and its development.

Early farmers most likely relied on trial and error to determine the crops most suited to the soils available. While early agriculturalists may have at first adapted to local soil conditions, in time through, deliberate management practices they also transformed local soils (Sandor *et al.*, 2006). Evidence of tilling and irrigation, dating from 9 000 and 7 500 B.C.E. (Before Current Era) respectively, indicate active soil management practices and understandings. By 200 B.C.E., an array of technologies such as agricultural calendars, ploughs, irrigation, animal-pulled seed drills, contour ploughing and bench terraces to minimise erosion, as well as manure and other natural fertilizers were in use at various locales (Wu *et al.*, 2019; Sandor *et al.*, 2021). Toward the end of the Roman empire, circa 450 C.E. (Common Era), “the Romans had a form of soil classification that included consideration of grain size, color, density and structure, and fertility and had some recommended tests for determining the properties and fertility of soils” (Brevik & Hartemink, 2010a:25) (See Winiwarter (2006:8) for a table of ancient Roman soil classification). Columella, a Roman writing in the first century C.E., identified tests for soil acidity and alkalinity, and noted the importance of subsoils and diversified farming (Olson, 1943). The Romans and Assyrians also knew enough about soil to purportedly plough salt into their enemies’ soils to vanquish them (Ridley, 1986). It has however been argued that the mode of these early soil sciences was that of observation and not experimentation (Malik, 2016), while others argue that Latin writers rigorously documented applied soil science (Winiwarter, 2006; Buol *et al.*, 2011:6).

It has been argued that poor soil management practices also contributed to the demise of ancient civilizations such as those of the Sumerians and the Babylonians (McNeill & Winiwarter, 2004; Dotterweich, 2013). The collapse of the former was caused by chronic crop failures due to irrigation-induced soil salinity and water logging; while that of the latter by topsoil losses and irrigation canal siltation due to deforestation (Brevik & Hartemink, 2010a). Citing various historical examples, Montgomery (2012) argues that a ‘boom-and-bust’ agricultural cycle is evident across numerous civilizations. Advances in soil knowledge and the concomitant intensified agricultural production allowed populations to expand, but eventual soil nutrient depletion and/or erosion, ultimately led to their collapse. Similarly dire warnings have been made about modern day civilization and its unsustainable agricultural practices (Kraamwinkel *et al.*, 2021).

In turn, the fall of the Roman Empire saw a collapse of the sciences in western Europe. This resulted in much loss of ancient soil knowledge, which may be one reason why agricultural productivity during the Middle Ages declined (McNeill & Winiwarter, 2004; Olsson & Paik, 2013). By contrast, between 400 and 1000 C.E. saw the burgeoning of Arabic cultures in the Middle East, with much scientific practice and discovery (Lag *et al.*, 2008). Different soils were understood to be suited to particular crops, fertilizers were applied to increase yields, agricultural calendars were written, and irrigation networks were mathematically designed to deliver water to crops. Similarly, during this period, Chinese soil knowledge was systematically developed, particularly the conducting of soil surveys and categorizing different soils. This information was utilized by government to regulate agricultural soils and crops and taxation. With limited arable soils, the Japanese made advancements in crop rotation, terracing steep slopes, and conducted frequent land surveys. In India too, soil surveys were undertaken; ploughing was commonplace and fallow periods were promoted to restore soil fertility (Abrol & Nambiar, 1997; Brevik, 2005; Brevik & Hartemink, 2010a; Wu *et al.*, 2019). Pre-Hispanic Latin American soil knowledge was extensive, and extended to deliberate, man-made soils (anthrosols termed *terra preta*) and raised fields. Moreover, local soil classifications and horizons were documented using complex toponyms, glyphs, and pictographs. Such LSK was intertwined with local cultural beliefs and practices, lending to long-term soil fertility and land-use sustainability (WinklerPrins & Barrera-Bassols, 2004; Williams, 2006; Sandor *et al.*, 2021).

The rise of western science however, aimed to establish a scientific and definitively universal soil knowledge. Interestingly, the literature on the history of soil science shows a markedly similar form to the academic literature on the history of mathematics, as Kitagawa (2019:1) pointedly states:

[T]his approach, usually beginning in ancient times [creates] a historical narrative from several different parts of the world. However, as the timeline reaches the Age of Enlightenment, the focus is more exclusively on European mathematicians. Because the significance and consequences of ‘scientific revolution’ were undeniably large, it created a common impression that modern math originated in Europe and spread to other parts of the world.

Similarly, from interviews with 40 leading soil scientists, Sigl *et al.* (2023) found that experts pegged the distinct origins of the discipline to be around 1900. Thus, considering the available,

if skewed, academic literature, the chapter now turns to the origins and development of the dominant WSS canon.

4.3 The Origins and Development of (Western) Soil Science

In western Europe, the Renaissance Period (circa 15th to 17th Centuries) was marked by the rediscovery of ancient Greek and Roman soil science, and further advancements in related knowledge. This developed into the ‘age of reason’, known as the enlightenment, circa the 18th Century. Various theories relating to soils and plant nutrition rose and fell, which ultimately generated nascent knowledge of soil chemistry. In the 1760s, Lomonosov – credited by some as the first Russian soil scientist – introduced the term *chernozem* to the scientific discourse (soils exhibiting a thick, black, organic-rich A-horizon) (Spaargaren, 2008). He also recognised the importance of weathering, living organisms, and significant spans of time in the genesis of soil and its layered nature. Contemporaneously, other 18th Century scientists of the enlightenment – while not yet distinguishing soil science as a distinct science – further developed Renaissance ideas of nutrient cycling, soil structure, and organic soil matter and nutrients (Brevik, 2005; Krasilnikov *et al.*, 2010). The ‘mineral theory’ of plant nutrition for example, was well accepted by the 1840’s, and replaced the preceding and disproved ‘humus theory’ of plant nutrition. Interestingly, it was Charles Darwin who in 1881 birthed soil biology as a scientific discipline. Darwin identified the importance of earthworms and other animals in soil formation: how they affect weathering, pedogenesis and soil profile differentiation, textural sorting and soil nutrient enrichment, along with bioturbation and humus formation. (Feller *et al.*, 2003; Brevik, 2005; Manlay *et al.*, 2007; Johnson & Schaetzl, 2015). By this point, western European governments were including soil fertility assessments in land taxation management surveys. Furthermore, around this time in The Netherlands and England, marshy soils were effectively and economically drained to reclaim arable land (Brevik, 2005). This is significant, as in the modern day, approximately 50% of wetlands worldwide have been converted to (primarily) agriculture by means of drainage (Verhoeven, & Setter, 2010).

The epistemic of WSS thus is rooted in the enlightenment and its values of rationality and progress (Grenz, 1996). It was closely associated with, the disciplines of agronomy and geology, and was accordingly directed to serve the ends of increased agricultural productivity (Landa & Brevik, 2015). To this end, soil was primarily viewed as an inert structural growth

medium (Mermut & Eswaran, 2001; Francis & Tóth, 2022; Radcliffe, 2022). By the early 1800s for example, the all-embracing aim of soil science in the recently independent United States of America (U.S.A.) was to systematically improve productivity to support nation-building. That is to say that fertilizer trials and soil investigations were conducted scientifically, with the overriding intent of improving soil management to increase crop yields – as Cohen (2010:861) puts it, “to transform the products of the land more effectively into saleable goods”. Similarly in Russia, it was the economic and agricultural production imperatives of the large, landed estates that drove soil investigations (Lag *et al.*, 2008). However, as Brevik and Hartemink (2010b:19) point out, there was still no ‘unified’ discipline of soil science:

In the 1800s the agrogeologists, agrochemists, and agronomists all had their own views of soils, there was no united soil science. Agrogeologists viewed soils as the weathered exterior surface of the Earth, dependent primarily on the underlying bedrock for their properties and ignoring or minimizing other influences. Agrochemists believed soils should be studied based on their chemical properties, with little regard for the environment within which the soil formed. Agronomists viewed soils as a medium to support the growth of plants.

The early 19th Century subsequently saw developments in soil cartography which allowed for large-scale soil surveys to be undertaken in the U.S.A., eastern Europe, Germany, France, Austria, the Netherlands, Belgium, Russia and Japan. Importantly, soil mapping started to become distinct from geological mapping. Soil maps were drafted based on surveys of soil properties, rather than simply the underlying geology which previously had been assumed to entirely dictate surface soils (Brevik, 2005).

In any event it was only in the late 19th Century, that WSS came into its own as a distinct discipline. For a field of study to be termed a distinct and ‘special science’ by philosophers of science, it must, at its core have fundamental concepts unique unto itself, which cannot be reduced to a more basic science. In the case of soil science, these unique conceptual characteristics are: “(i) the formation and properties of soil horizons, (ii) the occurrence and properties of aggregates in soil, and (iii) the occurrence and behaviour of soil colloids” (Churchman, 2010:215). It is the Russian geographer and geologist, V.V. Dokuchaev, who is correspondingly considered the progenitor of modern soil science, with his theories on pedogenesis dating back to 1879 – which still underpin the discipline today (Bockheim *et al.*, 2005; Brevik & Hartemink, 2010b; Krasilnikov *et al.*, 2010).

Dokuchaev drew on foregoing discourses and developed and synthesized the very important concept of the soil profile (soil morphology). He introduced the fundamental concept – which remains in use today – of the A, B and C horizons constituting a soil profile (with A+B comprising soil, and C the parent material). Further to this – and by way of experimentation and field observations – Dokuchaev dismissed the preceding chemical approach to soil classification, the agrogeological definition of soil, and the agronomic view of soils. His approach thus diverged from previous views of soil science as a sub-discipline of geology or chemistry or as a branch of agronomy. Rather, with his 1883 publication of *Russian Chernozem*, Dokuchaev effectively inaugurated soil science as its own research discipline. Particularly with his work on ‘genetic soil science’ recognised soil as an independent natural body.

This ‘genetic’ understanding of soils, was based on Dokuchaev identifying the five soil forming factors still recognised today, namely: (1) climate, (2) parent material, (3) organisms, (4) slope/topography, and (5) time. He showed that, by means of these agents and their interactions, soils are formed. This ‘genetic’ soil model (as it was known in Russia, and pedology as it became to be known in the west), has come to be the prevailing soil morphology model throughout the world since mid-20th Century (Yaalon, 2000; Arnold & Eswaran, 2002; Brevik, 2005; Brevik *et al.*, 2015; Teoharov, 2017; Moon, 2018). Brevik and Arnold (2015:2) codify it simply as: “soils are formed under the influence of parent materials, topography, organisms, and climate acting over time”. With modern soil science’s core paradigm not yet being 150 years old, makes it a relatively young scientific discipline. Moreover, this genetic model, only spread its epistemic influence from Russia to the west in the 1920s (by way of the 1924 foundation of the International Society of Soil Science (ISSS)) (Brevik, 2005; Teoharov, 2017).

After the first and second world wars, the prevailing social milieu from the 1930’s, through to the 1970’s was one of rebuilding and scientific advancement. Schumaker (2001:23) refers to this period as the “development science movement [...stemming from] the drive for national efficiency”. These were well-funded ‘boom’ years for quantitative WSS (Selcer, 2011; Brevik *et al.*, 2016). The positivist values of quantification, classification, productivity and objectivity became further entrenched in the discipline (Olson, 1990; Žukauskas *et al.*, 2018; Grix, 2019;

Cat, 2024). This positivist worldview can, for example, be seen in Hockensmith's (1948:451) statement regarding the (then) aim of soil science: "[to] classify the land and in working out the right combination of practices to make full use, without waste, of the land resources". Another notable example is Hans Jenny's 1941 book *Factors of Soil Formation: A System of Quantitative Pedology*, which became highly influential of soil science's epistemic. Jenny posited that Dokuchaev's five soil forming factors could be regarded as state factors in a 'solvable' mathematic equation. It was conceived that while four of the five factors were controlled for, the other variable could be studied. While soils proved themselves too complex to be reduced to a mathematical equation, the concept was very influential in the discipline (Bockheim *et al.*, 2005). This era also saw the United States Department of Agriculture (USDA) first published *Soil Taxonomy* in 1975. The theoretical schema of *Soil Taxonomy* is based upon Dokuchaev's soil forming factors (Bockheim *et al.*, 2014). Alongside the United Nations Food and Agriculture Organisation's (UN FAO) World Reference Base (WRB), *Soil Taxonomy* is considered a 'global standard' amongst soil classification schema. Soil science established its epistemic identity as a hard science during these 'boom' years (Brevik *et al.*, 2016). Brevik and Hartemink (2010a) point out that since its inception, the discipline had over time become more quantitative, replacing descriptive qualitative epistemological modes in the discipline.

The 1980s however saw a "perceived legitimization crisis in the [soil science] discipline, [which called] both its societal relevance and its academic legitimacy into question" (Sigl *et al.*, 2023:79). The discipline had been slow to broaden its areas of research, and with new high-yield crops, the value-add of soil science's traditional agronomic focus dwindled (Sigl *et al.*, 2023). Rather, it was other disciplines that focused more holistically on soils – bringing increased social and environmental considerations – and thus began shaping and leading the environmental discourse on soils. These included, *inter alia*, geographers, environmental engineers, anthropologists, soil biologists, biogeochemists, social and metagenomic ecologists, along with studies in agromedicine and ethnopedology. This new research focused on issues such as: ecosystem balance, soil fertility, human health, sustainability, climate change, and food security (Schlesinger & Andrews, 2000; Barnard & du Preez, 2004; Granjou & Phillips, 2019; Krasilnikov & Tabor, 2009). The 1980's and 90's concomitantly saw a decline in funding for soil science (Brevik *et al.*, 2016). In the 1980s for example, the discipline was predominantly defined by pedology and soil physics. Only subsequently were soil ecology, soil biology and digital soil mapping accepted into the discipline (Sigl *et al.*, 2023).

In the last two decades, with the rise of humanity's awareness of self-inflicted environmental pressures, soil scientists necessarily embraced these environmental linkages and sustainability considerations (Doran, 2002; Yaalon, 2003; Hartemink, 2015; Landa & Brevik, 2015). Findings of another recent study highlight that research interest in all sub-disciplines of soil science is expanding exponentially, with ecology and environmental sciences being the most prominent (Francis & Tóth, 2022). More recently, linkages to soil microbiology and the sociology and economy of soil use and management have begun to be accepted (Sigl *et al.*, 2023). Soil science has accordingly had a “renaissance”, and soils have made their way back firmly onto the global sustainability agenda focusing on themes such as environmental degradation, climate change and food security (Hartemink & McBratney, 2008:123; Bouma, 2009; Evans *et al.*, 2022). Blum (2005) summarised the importance of soils to society into six biological and non-biological functions, as follows: (1) biomass production e.g. food, fodder, raw materials etc.; (2) protection of humans and the environment i.e. filtering, buffering and transformation capacity between atmosphere, hydrosphere and biosphere; (3) genetic reservoir e.g. biodiversity habitat and seed bank; (4) physical location e.g. for transport, building, waste disposal etc.; (5) raw materials e.g. aggregates, minerals, water etc.; and (6) cultural heritage i.e. archaeological and paleontological. Soil science is thus focused at a vital ‘sustainability nexus’. Soils are the dynamic interface between the lithosphere, hydrosphere, atmosphere and biosphere. Soils are the basis for, *inter alia*: food production and security; production of fuel, building and clothing materials; water storage, filtering and flood buffering; biomass production and anchoring; biodiversity conservation; biochemical nutrient cycling; the engineered built environment; waste disposal sites; medicine manufacture; human and livestock nutrition; carbon sequestration and climate change buffer (Brevik, 2005; Lal, 2007; Adewopo *et al.*, 2014; Brevik, 2015; Rodrigo-Comino *et al.*, 2020; Peake & Robb, 2021). The importance of soils as a vital non-renewable resource, and that soils are globally increasingly degraded, can thus not easily be overlooked.

Importantly, to be in a position to discuss knowledge claims the knowledge ought to be relativized to its socio-historical context (Bloor, 1999). This section has done this by tracing the epistemic development of modern WSS. It has been shown that soil science's canon remains rooted in its enlightenment heritage – which in the current age of postmodern

understandings – reveals inherent biases (Morreira *et al.*, 2020). The next section accordingly turns to highlighting evidence of inequities within the discipline (proceeding from the enlightenment values embedded in its canon) and critiques these from a modern-day perspective.

4.4 Biases in (Western) Soil Science

The following sections will highlight and critique biases in WSS. The following three broad and interrelated categories are used as a framework to examine the biases in the discipline: (1) epistemic and canonical biases, (2) systemic and institutional biases, and lastly (3) biases as evidenced in Africa and South Africa. The section concludes by arguing that the discipline needs to reflect on its history and epistemic positionality; that its current biases serve neither the discipline nor its aims, whereas diversity does; and that meaningful engagement with LSK may expand modern soil understandings.

4.4.1 Epistemic and Canonical Biases

Having traced its epistemological history, modern WSS developed within the philosophical and moral milieu of the enlightenment. The attendant philosophies of positivism and pragmatism remain deeply embedded in the discipline today, including in the canon taught at tertiary level. Teuber (2022:759) critiques western soil scientists' epistemic approach, in that they: "look upon soil in a mainly technological, generalized and standardized way, they do not consider the cultural framework of soil knowledge." Cohen (2010:861) further underscores that the discipline's development was underpinned by the enlightenment's values of "progress, rationality, and knowledge production". While *prima facie* this approach may seem both logical and well-intentioned, we can now discern the unintended social and environmental impacts of what is now argued to be an essentially colonialist and extractivist approach (White, 1967; Lag *et al.*, 2008; Cohen, 2010; Krupenikov *et al.*, 2011). Rather, we now live in a postmodern age: "where the modernist referents of science, industry and technology, and faith in the application of reason and logic experience a *crisis of confidence*; where the modernist [enlightenment] project is now questioned" (Jarvis, 1998:130; Dastile & Ndlovu-Gatsheni, 2013).

Thus, the enlightenment epistemic of the modern WSS canon must also be questioned in this regard. Conspicuously, soil is also synonymous and negatively associated with dirt, dirtiness, muddiness and being ‘soiled’ in western culture (de la Bellacasa, 2015; Brevik *et al.*, 2020). Munteanu (2006:1) in particular speaks of the need to inquire into “the ontological and epistemological value of the present day concept of soil as used in soil science”, and further poses the question: “how do the historical and cultural settings affect the concept, content and quality of knowledge upon soil?” In this vein, the discussion turns to locating and problematizing WSS’s mono-episteme. This is followed by detailing evidence of the systemic social inequalities in the knowledge production of its canon.

As previously demonstrated, WSS’s origins are embedded in the enlightenment. Scientific definitions of soil accordingly remain primarily grounded in Dokuchaev’s deterministic ‘genetic’ model (also known as functional–factorial model or the state factor model) (Johnson & Schaetzl, 2015). Brevik & Arnold (2015:2) distil this as follows: “Soils are natural bodies. Soils are both spatial and temporal. Soils form at the surface. Soils are the result of complex biogeochemical and physical processes. Soils are capable of supporting life. Soils can be mapped at appropriate scales.” The definition of soils may however vary based on the end users and their intended application (Patzel *et al.*, 2023). Engineers for example may define soil as: “all unconsolidated materials above bedrock”, while geologists deem it to be: “the natural medium for the growth of land plants” (Bates & Jackson, 1980:592; Moon, 2018). Nevertheless, Figure 4.3 further illustrates that Dokuchaev’s genetic soil model (and its enlightenment origins), while having been refined, remains at the core of present-day soil science’s epistemology.

Pre-1880	Concept of soil as a medium for plant growth and as a weathered rock layer.
1880–1900	Appearance of fundamental pedology concepts: soil as a natural body; soil horizons/profiles; soil-forming factors; early ideas of soil geography.
1900–1940	Global acceptance of concepts of soil as a natural body and soil-forming factors; development of first regional soil classification systems; soil surveys initiated; identification of key soil-forming processes.
1940–1960	Factors of soil formation and genesis of soils clarified; development of global soil taxonomic systems; intensified soil mapping.
1960–1990	Refinement of global soil taxonomic systems; identification of pedon concept; development of early soil models and soil cover pattern concept; recognition of co-evolution of soils and landforms.
1990–present	Increased understanding of soil processes; refinement of global soil models; further refinement of global soil taxonomic systems; development of statistical and computer-based soil information systems.

Figure 4.3: Conceptual milestones in the soil science canon (Source: Bockheim *et al.*, 2005:32)

Accordingly, soil science has traditionally been divided into the following sub-disciplines: (1) soil chemistry, (2) soil physics, (3) pedology (genesis and taxonomy), (4) soil mineralogy, and (5) soil biology (Brevik *et al.*, 2021). It can be seen that each of these sub-disciplines broadly map onto the five soil forming factors, *viz.* soil chemistry (climate and parent material), soil physics (slope/topography and parent material), pedology (time and parent material), soil mineralogy (climate and parent material), and soil biology (organisms and parent material). The centrality of parent material speaks to the ‘genetic’ nature of Dokuchaev’s model, in that “distinctive combinations of geologic materials and processes produce distinctive soils” (Buol *et al.*, 2011:12). Importantly, this intersecting nature does allow for interdisciplinarity in soil science. This concept of soil genesis thus, “integrat[es] the concepts, theories, and facts of these subfields of soil science into a holistic, integrated, multi- disciplinary view of soil as a natural entity” (Buol *et al.*, 2011:6).

Undeniably, WSS has made immense contributions to the viability of modern day civilization. Contrary to Malthus, and by way of industrialised farming techniques and chemical fertilization, food production increases (albeit not distribution) have largely kept pace with the

population explosion of the 20th and 21st Centuries (see Figure 4.4) (Hartemink, 2007; Janzen *et al.*, 2011; Lam, 2023). Soil science has been instrumental in understanding crop nutrient requirements and how artificial soil amendments could supply them (Greenland, 1991). It has for example been estimated that in 2008, nitrogen-fertilized crops comprised a notable 48% of food produced for the global population (Erisman *et al.*, 2008). Knowledge production in soil physics has also improved tillage practices, soil drainage works, erosion control and other engineering and land-use applications (Greenland, 1991). Due to soil's interface between the atmosphere, hydrosphere, lithosphere and biosphere – the discipline has also led to important understandings of global biogeochemical cycles (carbon, nitrogen, etc.), and consequently climate change (Yaalon, 2000; Lal, 2007). With the modern crises of land degradation and climate change, and the pressing needs to supply food, energy and water, soil science is well positioned to make positive inter-disciplinary scientific contributions to the achieving UN's Sustainable Development Goals (SDGs) (Keesstra *et al.*, 2016; Evans *et al.*, 2022). Lal *et al.* (2021), highlight that global soil health is integral to achieving many of the UN's 2030 Sustainable Development Goals (SDGs), namely: SDG 1 (End Poverty), 2 (Zero Hunger), 3 (Good Health and Wellbeing), 5 (Gender Equality), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry Innovation and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), and 15 (Life on Land).

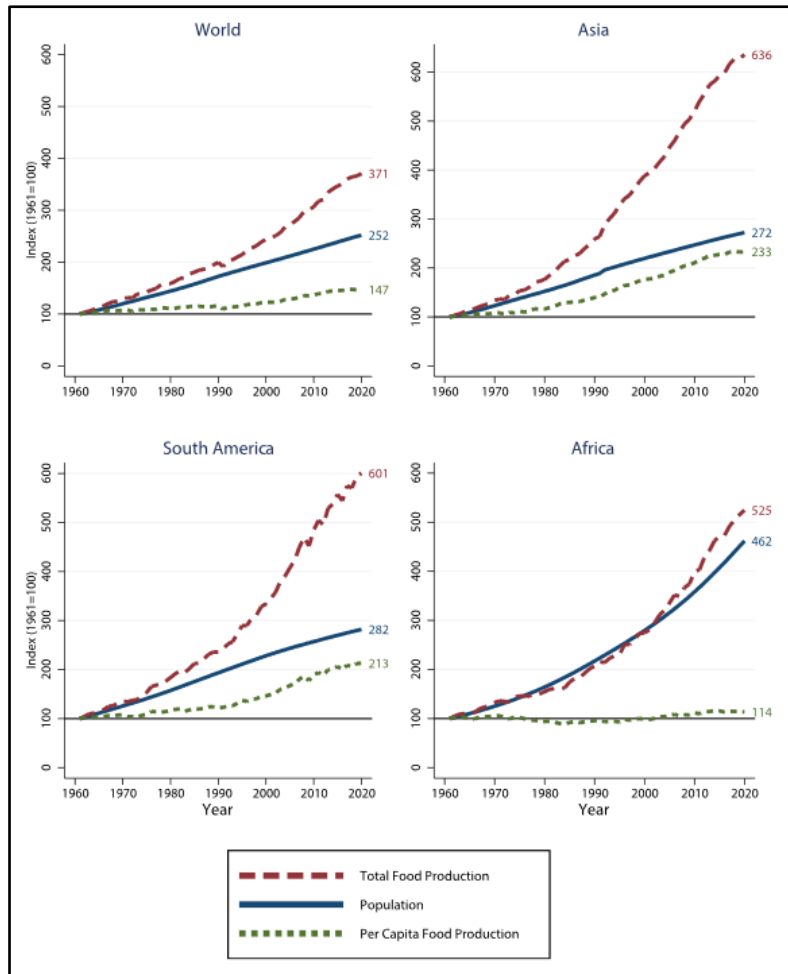


Figure 4.4: Population indices for the world, Asia, South America and Africa compared to indices of total and per capita food production between 1960 and 2022 (Source: Lam, 2023:4).

Nevertheless, while soil degradation is a natural process (involving, *inter alia*, erosion, leaching etc.), anthropogenic drivers have severely exacerbated the rate and severity thereof (Chen *et al.*, 2002; Salazar *et al.*, 2020; Dragović & Vulević, 2021). Dotterweich (2013) further cites studies which evidence that rates of natural soil denudation have been exceeded by anthropogenic soil erosion. Various studies estimate global soil degradation at 2 billion between 1 and 6 billion hectares, with almost 500 million hectares of soil in Sub-Saharan Africa (SSA) being classed as degraded (Chen *et al.*, 2002; Lal, 2010; Payne, 2010; FAO & ITPS, 2015; Gibbs & Salmon, 2015). Similarly, Du Preez *et al.* (2019) quantify almost a quarter of arable land globally as already degraded – with this problem being markedly worse in Africa, with almost two-thirds of productive land thus affected.

There is also significant research which points to other questionable results of enlightenment values underpinning human ‘progress’ in the realm of soils. Mouzakis (2017:1) states that critics of modernity widely agree that the enlightenment notion of “endless progress” is problematic. The narrow view of soil as a medium for production for example, has resulted in the excessive use of fertilizers and pesticides that “accelerate and exhaust the productive capacity of soils” (Minami, 2009:611). This continuous use of agrochemicals and fertilizers negatively impacts the sustained biological functioning of soils in particular – which is a key component in their nutrient cycling and renewability (Gunawardena, 2022). Lal and Stewart (2010) for example estimate the decrease in global per capita arable land area in the last 70 years as: 0.45 ha in 1950, 0.35 ha in 1970, 0.28 ha in 1990, and 0.22 ha in 2000, with projections estimating a decline to 0.15 ha by 2050. There is crosscutting consensus amongst soil stakeholders that intensified industrialised agriculture is predominantly responsible for this soil degradation (Rust *et al.*, 2022). Du Preez *et al.* (2019:111) highlight further flaws in the enlightenment approach to soils:

[T]he paradigm of industrial agriculture, which is premised on the view that the best way to deal with individual problems is to resolve each one separately. The remedies, according to this view, lie, for example, in the application of specific purchased inputs like fertilizers and pesticides, which may in turn degrade soil quality.

Kearnes and Rickards (2020) go further to critique the technoscientific terms in which dominate the academic discourse of the management of soil carbon for climate change mitigation. They state: “[problematically,] soil carbon sequestration is heralded as one of a number of strategies for *directly manipulating* environmental and climatic systems in response to global warming” [emphasis added] (Kearnes & Rickards, 2020:71). Such technocratic solutions are also specifically linked to efficient and profitable farm production (Thompson & Scoones, 2009; Kearnes & Rickards, 2020). Nürnberger (2012:1) critiques such results of these enlightenment viewpoints thus: “[t]he modern claim to mastery, ownership and entitlement and its spectacular successes has led to unprecedented power without a concomitant growth in responsibility.” There is a marked irony in that, the enlightenment values of perfection, progress and increased production – as championed by soil science – have contributed to the causation of such severe environmental challenges.

The ‘Great American Dust Bowl’ is a specific example of human-assisted catastrophic soil degradation this past century. In the 1930s, droughts in the American mid-West exacerbated

human-induced soil degradation. Rich topsoil had been exposed by the initiation of industrial agriculture and deep mechanised ploughing. Replaced by extensive cash-crop monocultures, native deep-rooted prairie grasses no longer maintained topsoil integrity and moisture. Thus drought wind-events, led to massive soil erosion and dust storms, with consequent loss of crops and livestock and human life (Figure 4.5). A western settler and expansionist mind-set underpinned these human drivers of soil loss (Worster, 2004; Baveye *et al.*, 2011; Holleman, 2019).



Figure 4.5: Dust storm in Baca County, Colorado, USA, 1935 (Photographer: Kernodle, 1936).

This enlightenment-rooted colonial and extractivist productivity mind-set has also been instrumental in contributing to soil degradation in Africa. Cash crops in particular – such as coffee, cotton, cocoa, tobacco, tea, palm oil, and sugar – negatively impact soils’ fertility and agricultural sustainability. This has been causatively linked to, *inter alia*, intensive monoculture practices, soil nutrient mining, chemical fertilizer input requirements, natural forest cover clearing, irrigation demands, and soil compaction (Blaikie, 1985; Thapa & Weber, 1991; Barbier, 2000; Drechsel *et al.*, 2001; Benjaminsen *et al.*, 2010; Tully *et al.*, 2015; Bjornlund *et al.*, 2020; Mesmin *et al.*, 2021; Amponsah-Doku *et al.*, 2022). Schwieger & Mbidzo (2020:1) provide a detailed case study in Namibia detailing how more sustainable pre-colonial Herero pastoral systems were upended and “current land degradation problems [...]

are intrinsically linked to past colonial interventions and policies.” Soil fertility in SSA is however affected by complex interactions of multifarious factors acting at local scales, and sweeping regional claims can be problematic (Vanlauwe & Giller, 2006; Kreike, 2008). Nevertheless, in the context of declining soil fertility and crop yields, soil science has by in large sought to crop uphold productivity through advocating intensification – thus contributing to a vicious and unsustainable cycle of soil degradation (Grove, 1997; Sauer & Nelson, 2011; Davidson & da Silva, 2024). Payne (2010:30) characterises the situation as “a net export of crop essential nutrients in African cropping systems”. The consequential social impacts of such soil degradation in SSA include, decreased food security and malnutrition, increased rural poverty, increased gender inequality, decreased freshwater access, out migration and resource conflict, cultural and IK losses, urbanisation pressures, and increased vulnerability to extreme events, including climate change. While attendant environmental impacts include: watercourse and coastal siltation and nitrification, disruption of nitrogen and carbon cycles, loss of soil organic matter, soil salinization, decreased efficacy of carbon sequestration and water retention, vegetation cover loss and desertification, and biodiversity and habitat loss (Blaikie, 1985; Reardon & Vosti, 1995; Scherr, 2000; Chen *et al.*, 2002; Muchena, 2005; Hart & Voster, 2007; Thompson & Scoones, 2009; Lal & Stewart, 2010; Payne, 2010; Lanz *et al.*, 2012; McBratney *et al.*, 2014; Oliver & Gregory, 2014, Reynolds *et al.*, 2015; Stull *et al.*, 2016; Lal, 2021; McNamara *et al.*, 2021; Ebhuoma *et al.*, 2022; Lal, 2022). African soils and Africans have thus sustained negative impacts stemming from the imposition of western enlightenment values upon soil management along with the marginalisation of their LSK (Showers, 2006; Mawere, 2013; Schwieger & Mbidzo, 2020). (See Section 4.4.3 for further discussion of biases in Africa and South Africa).

Considering these issues, it would be beneficial for western soil scientists to reflect on their discipline’s epistemic position and values (Munteanu, 2006; Amundson, 2017; Dazzi & Papa, 2022). In this regard, Sigl *et al.* (2023) interviewed soil scientists with regard to the discipline being slow to expand beyond the discipline’s traditional epistemic and accept other soil-related research. Findings shew that this recalcitrance stemmed from a defence of their ‘academic disciplinary integrity’ and a concomitant commitment to canonical bounds. Soil scientists have also expressed that this prevailing narrow disciplinary approach can further result in sub-disciplines being disconnected and narrow in focus, and also limit the practical application of soil science knowledge (Gardner, 1991; Muchena & Kiome, 1995; Hurni & Meyer, 2002).

Manlay *et al.* (2007) for example trace the development of the understanding of humus from a limited mineralogical definition to the very recent multi-dimensional ecological understanding thereof. As recently as the late 1980's, the now well-accepted notion, that diverse and healthy communities of microorganisms are of vital importance to soil fertility, was scorned (Krzywoszynska, 2019; Gobo & Marcheselli, 2022). Johnson and Schaetzl (2015) argue that Dokuchaev's genetic model while important, and allowing for an economic classification of soils, has overshadowed other understandings of soils. The authors cite Darwin's (largely neglected) contributions to understanding pedogenic processes, particularly bioturbation (faunal mixing). They conclude that synthesising conceptual soil models is vitally important, as, "while different in their basic structure and goals, [Dokuchaev's and Darwin's models] provide together a more complete view of pedogenesis than either can do singly" (Johnson & Schaetzl, 2015:176). Gardner (1991:3) similarly calls for fellow soil scientists to stretch their imagination toward soil's inherent complexity; as, "in our models of the soil our concepts were almost laughingly simplistic" (Gardner, 1991:3). While Hartemink and McBratney (2008) acknowledge that since at 1980's there have been numerous calls for the discipline to be more in touch with society at large.

Thus, while soil science is hugely relevant in terms of pressing social and environmental issues, the discipline can be insular, funding remains scarce, and low student enrolments are common (Adewopo *et al.*, 2014). To advance the discipline's epistemic within the current postmodern age, soil scientists must participate in far-reaching intra-, inter- and trans-disciplinary collaborative research, which unsettles universalizing epistemic assumptions (Mbembe, 2016; Long *et al.*, 2019; Kumalo, 2021). Sigl *et al.* (2023:86) contend that "for soil scientists to be successful in responding to current [social and environmental] problems, they are also required to effectively change the epistemic practices of soil science and collaborate with other fields." These include fields both within the natural sciences, and beyond, into the social sciences and humanities; *inter alia*: ethnopedology, microbial ecology, botany, politics, economics, environmental ethics, anthropology and sociology (Blaikie, 1981; King & Granjou, 2020; Salazar *et al.*, 2020; Tironi *et al.*, 2020; Pérez-Rodríguez, 2023; Sigl *et al.*, 2023). Ludwig & Boogaard (2021:25) similarly provide the example of soil science being necessary in addressing the challenge of global food production while requiring consideration and integration of diverse factors such as: "genetics of new crop varieties, the division of labour in agrarian communities, carbon emissions of livestock, profit margins of agricultural producers,

soil erosion, food security and sovereignty of smallholder farmers, local culinary traditions, and deforestation and spiritual practices.”

Nevertheless, this section has demonstrated that, by in large, the epistemic canon of western academic soil science remains largely positivist, narrowly focused, and adheres to enlightenment values. As argued in the next section, these biases are reflected in the institutions and systems of the academic discipline.

4.4.2 Systemic and Institutional Biases

The IUSS (International Union of Soil Sciences) is the international academic organisation for soil scientists, and it designates the canon of WSS. It was directly preceded by the ISSS, which was established in 1924 (Hartemink, 2015). The IUSS thus recently celebrated its centenary. The stated mission of the IUSS (2024a) is:

to promote all branches of soil science and its applications, to promote contacts among scientists and other persons engaged in the study and the application of soil science, to stimulate scientific research and to further the application of such research.¹⁷

The IUSS currently comprises 23 separate commissions¹⁸ focused on distinct academic research areas, which *in toto* outline the discipline’s canon and epistemic extent. Nevertheless, not one makes mention of ethnopedology or local and indigenous soil science knowledges. Based on Grenz’ (1996) enlightenment principles, a critical analysis of the IUSS’s definition for each commission further reveals a preponderance of universalizing positivist perspectives embedded therein (see Appendix 4.1). For example, Commission 2.4 on Soil Mineralogy states its aim as: “[to] promote modern approaches to soil mineralogy, such as data driven approaches, and especially those approaches that seek to advance understanding of the roles of soil minerals in relation to sustaining and enhancing the functions soils” (IUSS:2024:1b). Within this definition, the following inherently positivist biases can be apprehended: the primacy of quantitative methods; that ‘modern approaches’ are deemed quantitative; and, the productivity of soils is deemed a principle aim. Appendix 4.1 details a critical analysis of all

¹⁷ <https://www.iuss.org/mission/> [Accessed 29 June 2024]

¹⁸ <https://www.iuss.org/commissions/> [Accessed 11 June 2024]

23 IUSS commissions in light of Grenz' (1996) enlightenment principles. This analysis illustrates the positivist principles which predominate the definitions of all the IUSS's commissions.

Correspondingly, the enlightenment-rooted canon of soil science has (both historically and till quite recently), been dominated by western men. The published histories of the discipline almost exclusively centre white men, and their contributions to the canon (see for example: Greenland, 1991; Yaalon & Berkowicz, 1997; van Baren *et al.*, 2000; Helms *et al.*, 2002; Bouma & Hartemink, 2003; McNeill & Winiwarter, 2004; Bockheim *et al.*, 2005; Brevik, 2005; Feller *et al.*, 2006; Lag *et al.*, 2008; Brevik & Hartemink, 2010b; McNeill & Winiwarter, 2006; Anderson & Smith, 2011; Landa & Brevik, 2015; Teoharov, 2017; Moon, 2018; Sanchez, 2019; Borden *et al.*, 2021; Hartemink, 2021; Rusakova *et al.*, 2023). Figures 4.6, 4.7 and 4.8 illustrate this pervasive bias. Markedly, there are no women, nor people of colour recognised in this regard (even considering the unnamed African men standing with C. Kellogg in Figure 4.7). From a postmodern perspective, Jarvis (1998:119) problematizes this as follows:

Learned traditions, in other words, are merely the textual inscriptions of those who have been privileged enough to write; white males of largely European descent who, either wittingly or unwittingly, have replicated and legitimated the social and political order from which their privilege is derived.

By being in a position of privilege to write, and thereby establish the discipline's (western scientific) canon, white western male soil scientists became the authors of 'valid' soil knowledge. An academic canon written from such a singular social perspective, is however biased by its lack of epistemic diversity (Meyer, 2011; de Sousa Santos, 2015).



Figure 4.6: Vasily Dokuchaev sitting with students and colleagues (2nd row, 4th from left, circa 1892) (Johnson & Schaetzl, 2015:117).



Figure 4.7: Notable soil scientists as depicted by the discipline's historiographic literature.

Further to this, various authors state that there is only a modicum of literature on the history and development of modern soil science as a distinct discipline (van Baren *et al.*, 2000; Bouma & Hartemink, 2003; McNeill & Winiwarter, 2004). Figure 4.8 below depicts these prominent documenters of the history of soil science, all of whom are white and male; namely: Dan Hardy

Yaalon (Israel), Eric Brevik (USA), David Moon (UK), Alfred Eduard Hartemink (The Netherlands), Rhodes Whitmore Fairbridge (Australia) and Benno Peter Warkentin (Canada). In a further example: of the twenty-two articles in the seminal *History of Soil Science: International Perspectives* (1997) edited by Yaalon and Berkowicz, there is not one article on an African country, nor African soil scientists, nor African soil knowledge. In yet another instance, Amundson, in the foreword to Hartemink's (2021:viii) chronicle of American soil science, unabashedly states:

While the characters in this history are mostly dead, and (yes) white, and (yes) men, the immigrant backgrounds that many came from, and the economic and sometimes political hardships that many faced, are indeed a fundamental part of the fabric of Americana.

There is thus an obvious lack of diversity in both establishing and chronicling the academic canon of soil science.



Figure 4.8: Prominent academics documenting the history of soil science.

Mays *et al.*'s (2002:196) research on the historical participation of African Americans in the discipline is an exception to this; the authors underscore that:

[t]he U.S. Soil Survey offered few opportunities for minorities during its first 60 years. Since the passage of civil rights legislation in the 1960s, however, the soil survey has become more inclusive. The employment profile of the soil survey in the 1990s, while still predominantly white and male, now includes minorities, particularly African-Americans.

This research documents a number of African Americans whom, despite the odds, managed to qualify as soil scientists (see Figure 4.9). Notwithstanding this, there is no mention of their research contributions becoming disciplinary canon; and conspicuously, all those mentioned are male, except one. The aforementioned historians of the canon of soil science unsurprisingly make no mention of any of these African American soil scientists. This is likely as the Historically Black Universities (HBUs) which trained these African American soil scientists, were without federal research funds till the late 1970s (Mays *et al.*, 2002).



Figure 4.9: One of the few photos in the academic literature on this history of the discipline which depicts and names soil scientists of colour. (Sitting, from left: Ronald E. Jarrett, Dewayne Mays, and Elmer J. Polk. Standing, from left: Joseph J. Castille, Bobby J. Ward, Sylvester Bobo, George R. Hadnot, and Milton Lynn) (Source: Mays *et al.*, 2002:178).

The nationality and gender of office holders in the IUSS is yet another critical example of the limiting male and global North frame of reference which continues to define the discipline's

academic canon. For instance, between 1924 and 2022, not one of the 22 presidents¹⁹ of the IUSS, had been from the African continent. See Figure 4.10 and Appendix 4.2 for details. While one of the 24 international soil science congresses between 1924 and 2030 was held in Africa – it was held under colonial rule in Léopoldville in 1956 in the then Belgian Congo (van Baren *et al.*, 2000). In 2022 however, 98 years after its inception, the IUSS elected its first president from an African country – Professor Victor Okechukwu Chude from Nigeria – for the term 2025-2026 (see Figure 4.11) (IUSS, 2024c). Moreover, Díaz-Raviña and Caruncho (2022) emphasize that the IUSS only elected its first female president (Laura Bertha Reyes-Sánchez of Mexico) in 2019, after 95 years of existence. These authors go on to call attention to the fact that amongst IUSS honorary members (an award for distinguished soil scientists (van Baren *et al.*, 2000), women comprise only 3% of awardees compared to the 97% of male recipients of the award. Nevertheless, noticeably, all of these awardees are white women (see Figure 4.12). An African man has only received this honour once (Hassa M. Hamdi of Egypt in 1998) (IUSS, 2024d). Figure 4.13 correspondingly depicts the continental affiliation of the 117 recipients of this honorary membership since 1924.

¹⁹ <https://www.iuss.org/iuss-presidents-and-executive-committee/past-officers/> [Accessed 27 June 2024] (Also see Appendix 4.2).

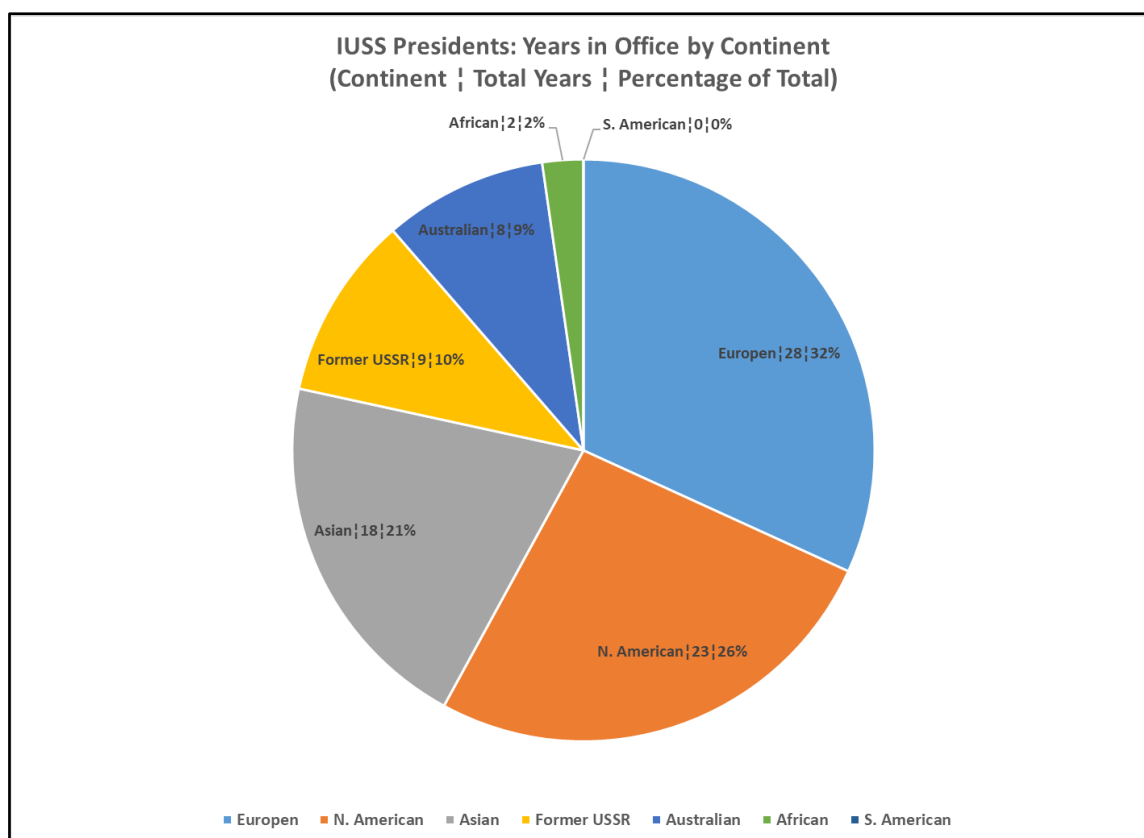


Figure 4.10: IUSS presidents' affiliation: years in office by continent, since 1924.



Figure 4.11: Victor Okechukwu Chude (Nigeria), first elected IUSS president from an African country – for the term 2025-2026 (Source: IUSS, 2024c).



Figure 4.12: Laura Bertha Reyes Fernández, first and only female president of the IUSS, and the four female recipients of IUSS Honours award, since 1924 (Top left to bottom right: Maria M. Kononova (USSR: 1974), Maria Gerasimova (Russia: 2016), Mary Beth Kirkham (USA: 2016) and Rosa M. Poch Claret (Spain: 2020)) (Source: Díaz-Raviña & Caruncho, 2022).

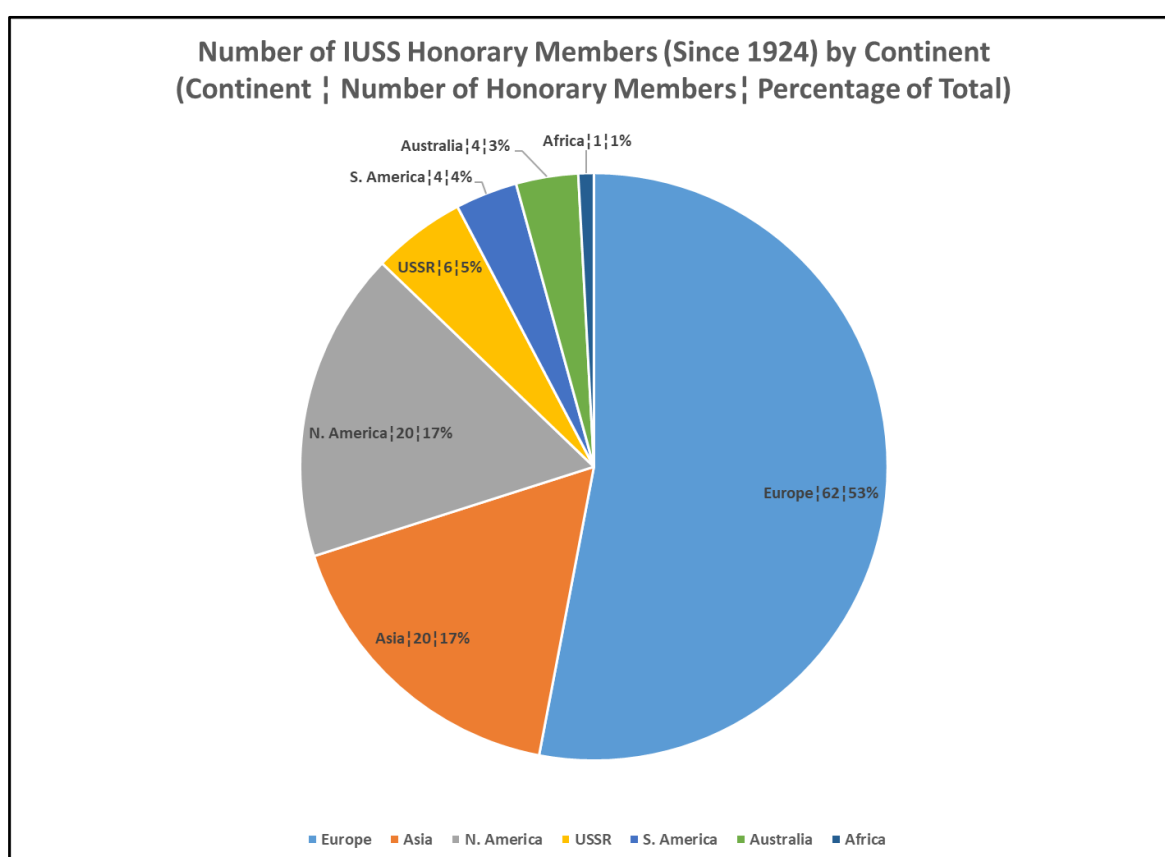


Figure 4.13: Number of IUSS honorary members by continent, since 1924.

It is a further indictment of the IUSS's lack of diversity is that, between 2002 and 2026, of the 404 'officer' positions filled (e.g. commission and working group chairs, vice chairs, second vice chairs, etc.²⁰) – only 7 (or 1.7%) have been held by soil scientists with an African affiliation. Of these, only 3 were Black Africans (0.7%) (van Baren *et al.*, 2000; IUSS, 2024e). See Figure 4.14 and Appendix 4.3 for details. These inequitable percentages should be considered in light of the fact that Africa is the second most populous continent (after Asia at 59.1%). The African continent accounts for approximately 18.2% of the world's population – nearly double that of both Europe at 9.2% and South America at 8.3%; and almost four times that of North America at 4.7% (Worldometer, 2024). By the end of the 1990s the IUSS only had 7000 members, of which 270 from South Africa (van Baren *et al.*, 2000). However, it has seen significant growth in the last twenty years: “[circa 2015, the IUSS] has 60 000 members who are organized into Divisions, Commissions and Working Groups that deal with all aspects of soil research” (Hartemink, 2015:579). The recent publication: *IUSS Genealogy: 1924-2024* provides synopses of 55 of the 77 national member organisations of the IUSS. Represented are the following five African soil science organisations (representing 7 African countries) and their approximate 2024 membership: Burkina Faso (100 members); East Africa (comprising Kenya, Uganda and Tanzania) (450 members); Egypt (15 members); Nigeria (1500 members) and South Africa (350 members) – totalling at least ~2145 African members of the IUSS (Horn *et al.*, 2024). Thus, this marked underrepresentation of Africans in the IUSS at international level, is not an issue of ‘too few African soil scientists available to stand for office’.

²⁰ <https://www.iuss.org/iuss-presidents-and-executive-committee/past-iuss-division-commission-officers/>;
<https://www.iuss.org/working-groups/>;
<https://www.iuss.org/current-iuss-division-and-commission-officers-2022-2026/>;
 [Accessed 27 June 2024] (Also see Appendix 4.3).

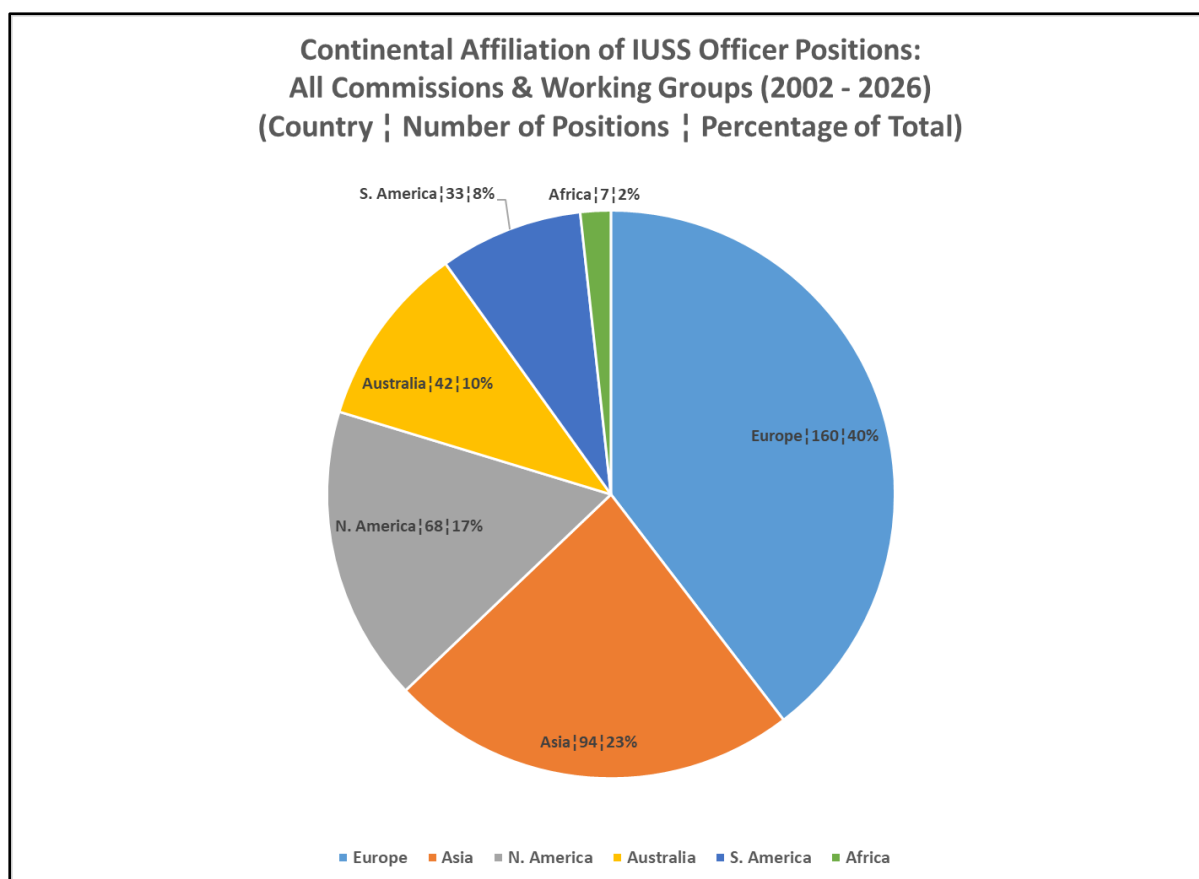


Figure 4.14: Continental affiliation of IUSS officer positions for all commissions and working groups: 2002 – 2026.

Only very recently there have been a few authors who have begun to critique the hegemony of white male domination in soil science (Vaughn, 2019; Carter *et al.*, 2021; Dawson *et al.*, 2021; Díaz-Raviña & Caruncho, 2022; Reyes-Sánchez & Irazoque, 2022; Grunwald & Daroub, 2023). In the U.S.A., while women may earn around half of the advanced soil science degrees, they are markedly underrepresented in academic faculty, particularly at professorial levels (see Figure 4.15) (Vaughn, 2019; Grunwald & Daroub, 2023). Díaz-Raviña and Caruncho (2022) found very similar trends in Spain. A wider study by Dawson *et al.* (2021) investigated gender equity in membership to 44 soil science societies globally. Overall women comprised only 32% of membership across all societies. While Africa did have the highest female membership at 40%, only two African societies were sampled and thus not truly representative. Further findings were that only 20% of these societies had a female president, and that women were also substantively underrepresented as keynote speakers at conferences, and on editorial boards of soil science journals. In line with broader initiatives for more equitable demographics,

academic soil science has seemingly not pushed transformation. Rather (and notwithstanding historical political reasons) the discipline continues to exhibit patterns of under-representation of historically disadvantaged groups (Carter *et al.*, 2021; Reyes-Sánchez & Irazoque, 2022). While these inequalities clearly exist, there remains no distinct gendered advantage to being a good or excellent soil scientist (Díaz-Raviña & Caruncho, 2022). The same can be said for the foregoing regional and racial inequalities evident in the discipline's institutions.

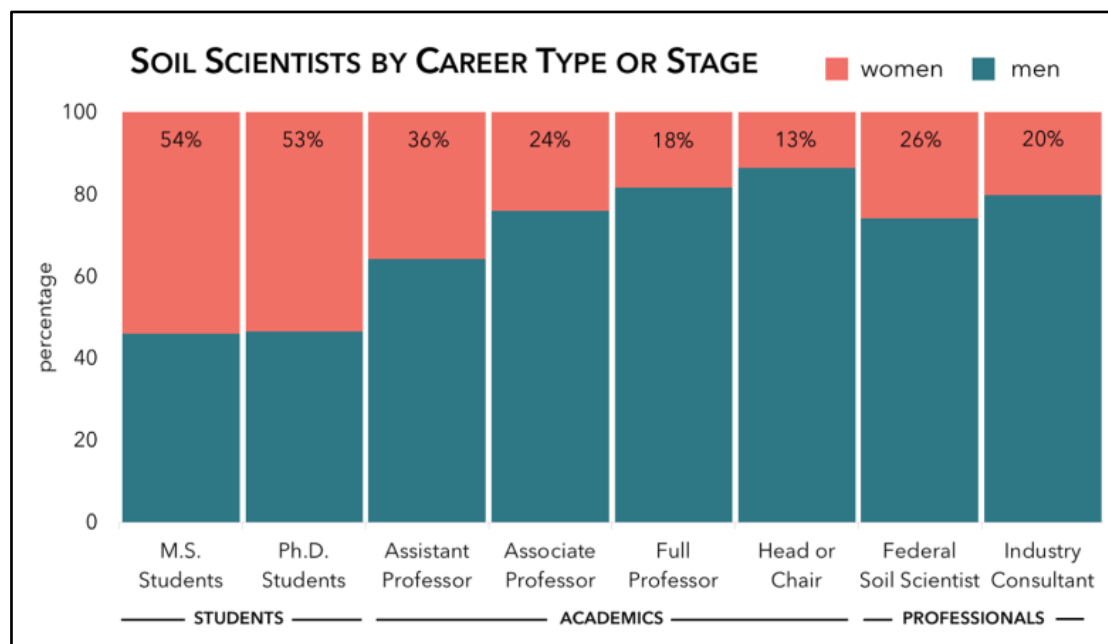


Figure 4.15: Gender distribution of American soil scientists: students, academics and professionals (Source: Vaughn, 2019).

Reyes-Sánchez and Irazoque, 2022:7 conclude that:

it is evident that the soil science community has not made enough efforts towards diversity; for gender, race, and origin, soil science has lower percentages of diversity than those of STEM in general, and much lower percentages of diversity than what the real population composition is in any country.

The discussion now turns to biases exhibited in the research and practices of WSS as specifically evidenced in Africa.

4.4.3 Biases as Evidenced in Africa and South Africa

Africa and its soils have often (and at times erroneously), been characterised by outside westerners (Showers, 2006). Around the turn of the 20th century, tropical soils in Africa were for example initially ‘deemed’ fertile due to the dense rainforests they supported. However, once colonial crop trials began, yields were found to be low – and the western ‘scientific’ outlook on these soils changed: judging soil fertility low and diminished by cultivation (Hartemink, 2002). In the nineteenth to the mid-twentieth century for example, European geologists and soil scientists travelled to the tropics, and without extensive field work, formed the inaccurate view about the ubiquity of laterites (hardened layers, heavy in iron oxides and unknown in Europe). They proceeded to publish what they deemed to be their novel findings about laterites in western academic journals. This consequently shaped general scientific beliefs (and publications and policy) about the tropics’ soils till at least the mid-1970s (Sanchez, 2019). Hartemink (2002:282) supports this conclusion by stating that “it was [erroneously] thought that the tropics were covered by laterite crust and lateritic soils, because a number of often-quoted [European] writers on laterite had never been in the tropics”. Problematically, while American and European soil scientists dominated studies of African soils, their understandings of soils were founded in the vast and recent (9 000 to 15 000 years ago) post-glacial loess (wind-blown deposits) of their own continents. Africa’s soils on the other hand developed over millions of years and differ substantively (Lag *et al.*, 2008).

Much like the international history of the discipline, the academic literature by in large, identifies these notable soil scientists working in Africa – as white European or American men. Figure 4.16 for example identifies ‘noteworthy’ soil scientists working on tropical soils in the Gold Coast (modern day Ghana) (Effland *et al.*, 2009). Lag *et al.* (2008) for example point out that in the 20th Century, it was British and French scientists who developed the study of African paleosols (ancient soils), and Germans who defined African saprolites (in-situ weathered bedrock). Along with other leading soil scientists such as the Englishman G.W. Robinson and the American C.F. Marbut, Dr. Charles E. Kellogg in particular (then Director of the United States Soil Survey), influenced soil classification in the tropics on his field trips in the 1950s (Effland *et al.*, 2006; Borden *et al.*, 2021).

Numerous articles trace the canonical advancements in tropical soils by two Englishmen specifically: Geoffrey Milne (Figure 4.17) in East Africa in the 1930's, and Cecil Frederick Charter (Figure 4.16) in West Africa in the 1940's (Muchena & Kiome, 1995; Msanya *et al.*, 2002; Effland *et al.*, 2009; Millera & Schaetzl, 2016; Borden *et al.*, 2020; Borden *et al.*, 2021). Milne in particular is identified as developing the concept of soil catenae, which remains in common use today. Catenae (from the Latin plural for 'chain') are sequences of genetically linked soils, as chiefly determined by their topographical (hillslope) position and the associated agents of erosion and deposition acting upon them i.e. uniformity of soil profiles along a certain topography (Yaalon, 1975; Zachar, 1982; Gennadiyev & Bockheim, 2006; Lal, 2016; Borden *et al.*, 2020). Notably, numerous indigenous soil classification systems have used topography as a key criterion (Barrera-Bassols & Zinck, 2003; Krasilnikov & Tabor, 2003; Borden *et al.*, 2020). It has been argued by various authors that to some extent, Milne and others appropriated LSK into the WSS canon (Sillitoe, 1998a; Birmingham, 2003; Payton *et al.*, 2003; Gowing *et al.*, 2004; Ngailo & Nortcliff, 2007). Figure 4.18 from Milne (1947) exemplifies this: depicting topographically related local-African soil names on a catena profile. This echoes Dokuchaev basing his initial studies and classifications on local Slovenian soil knowledge (Krasilnikov & Tabor, 2003; Lag *et al.*, 2008). Seemingly, Brammer, who continued Charter's work in Ghana, similarly adopted local soil concepts and nomenclatures (see Figure 4.19) (Effland *et al.*, 2009; Borden *et al.*, 2021).

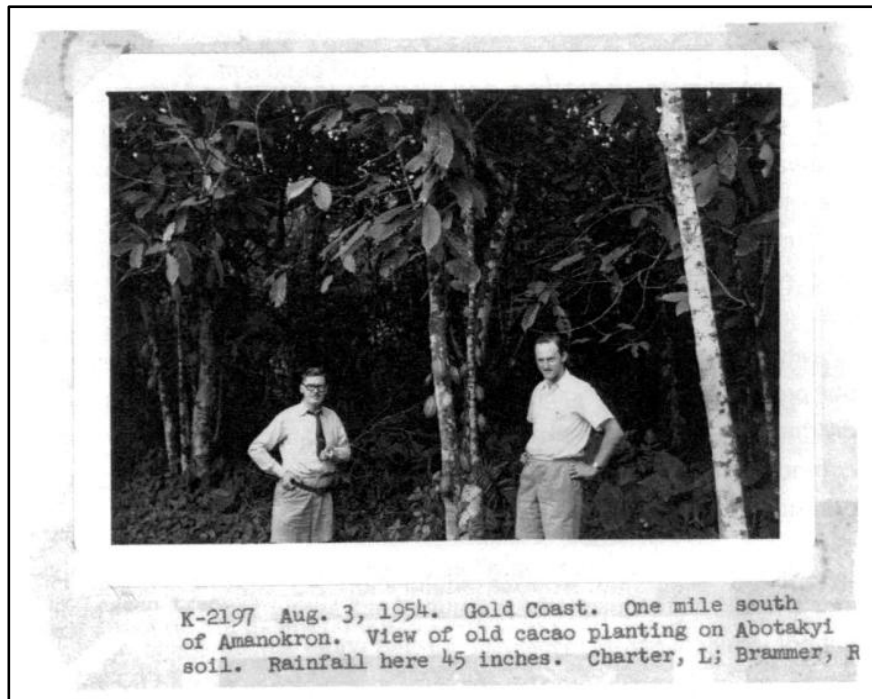


Figure 4.16: Cecil F. Charter and Hugh Brammer, ‘notable’ soil scientists in mapping and classifying tropical soils in the Gold Coast (present day Ghana) (Source: Effland *et al.*, 2009).



Figure 4.17: Photograph of Geoffrey Milne taken in 1937 at Amani, Tanganyika Territory (present day Tanzania) (Source: Milne, 1947:208).

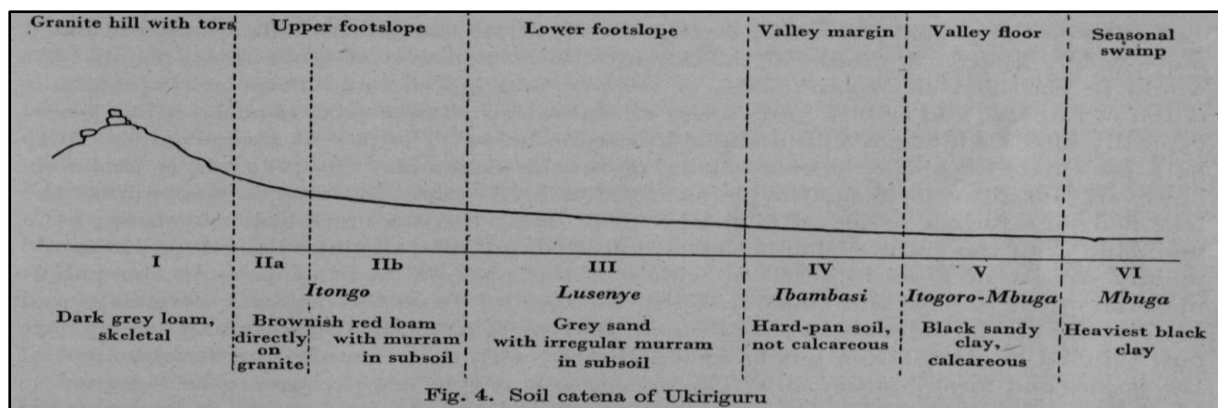


Figure 4.18: Geoffrey Milne's soil catena of Ukiriguru, Tanzania – including topographically-related local soil names (*viz*, Itongo, Lusenye, Ibambasi, Itogoro-Mbuga, Mbuga) (Source: Milne, 1947:259).

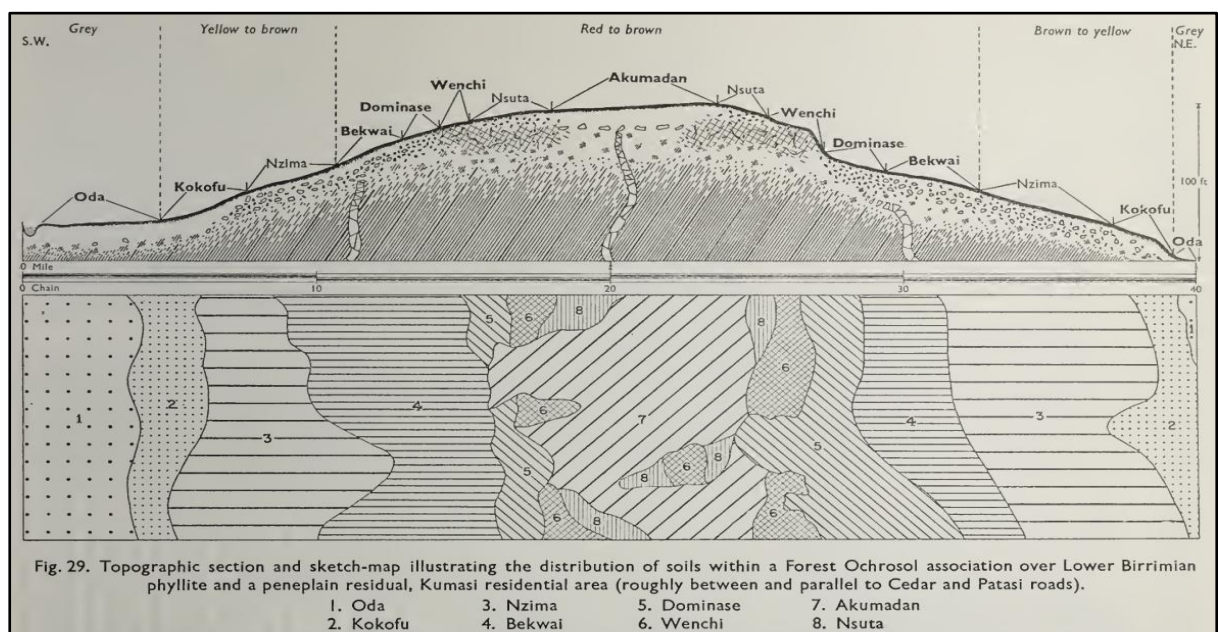


Figure 4.19: Hugh Brammer's topographic section of soils in Kumasi, Ghana – including topographically-related local soil names²¹ (*viz*, Oda, Nzima, Dominase, Akumadan, Kokofu, Bekwai, Wenchi, Nsuta) (Source: Brammer, 1962:96).

²¹ "Drift soils (*Akumadan*) occupy remnants of the intermediate erosion surface on the almost flat hilltop; sheet ironpan (*Wenchi*) and brown concretionary soils over ironpan (*Nsuta*) may occur locally on these remnants, but they more typically occur as a collar around the edge; on the slightly concave valley slopes below the ironpan outcrop occur drift (*Dominase*) and sedentary soils (*Bekzwai*, *Nzima*) containing in their upper parts varying proportions of material derived from the break-up of the ironpan collar; colluvial fine earth, probably accumulated in slightly earlier geomorphological phases than the present, mantles the lower slopes or occupies drainage grooves on the middle slopes (*Kokofu*); alluvial silty clays occupy the valley bottom (*Oda*)" (Brammer, 1962:93).

This can be deemed as an example of epistemic extractivism, in which:

the theory that is appropriated emerges as if ‘originally produced’ by the global North, whereas the peoples of the global South appear as if they simply provided the inputs and experiences that are immediately appropriated by the North and refashioned as sophisticated theories (de Sousa Santos, 2018:130).

Carter *et al.* (2021) further describe this as ‘helicopter’ or ‘parachute’ research, in which scientists from the global North conduct research with indigenous global South peoples, treating their knowledge as ‘raw data’, while little acknowledgment or benefit flowing back to those communities from the resultant research. The effects of this epistemic extractivism were explicitly political; in that this form of intellectual colonisation was imperialist and nationalist and “shaped the ways in which settler-society sciences conceived [and treated] their local environments” (Robin, 1997:63). Thus, western soil scientists both appropriated African LSK and also effected enlightenment values through colonial soil management in Africa, further biasing the canon of the discipline.

European soil scientists inevitably played a supporting role in colonial African contexts. Charter’s soil survey in Ghana for example was established in 1946 to investigate problems in cocoa production, specifically the link between soils and crop diseases (Effland *et al.*, 2006). Furthermore, Charter was awarded an OBE (Order of the British Empire) for his part in addressing the soil-related problems regarding the Groundnut Scheme in the British Tanganyika Territory (now Tanzania) (Borden *et al.*, 2021). In Malawi, during British colonial rule, 3.7 million hectares of land were appropriated from small-scale farmers to create large-scale commercial estates for cash crops like tobacco, cotton, and tea. Most soil and agricultural research and extension efforts supported these estates (Graeub *et al.*, 2016; Bjornlund *et al.*, 2020). Thus the scientific discoveries which led to the effective exploitation of these natural resources justified the economic benefits of colonisation (Robin, 1997). African colonies accordingly produced these cash crops for export to colonial powers (See Figure 4.20). Colonial powers also down-regulated pricing of export commodities, resulting in African farmers being unable to invest in agricultural productivity improvements (Bjornlund *et al.*, 2020). This exemplifies resource extractivism (of soil nutrients, sunlight, water) – which continues to the present day (Montgomery, 2012; Kolawole, 2012; Grosfoguel, 2020). Dea and Scoones (2003:466) conclude that: “networks of [soil scientists], linked to centres of power and decision-making, can have enormous influence in direct material terms.”

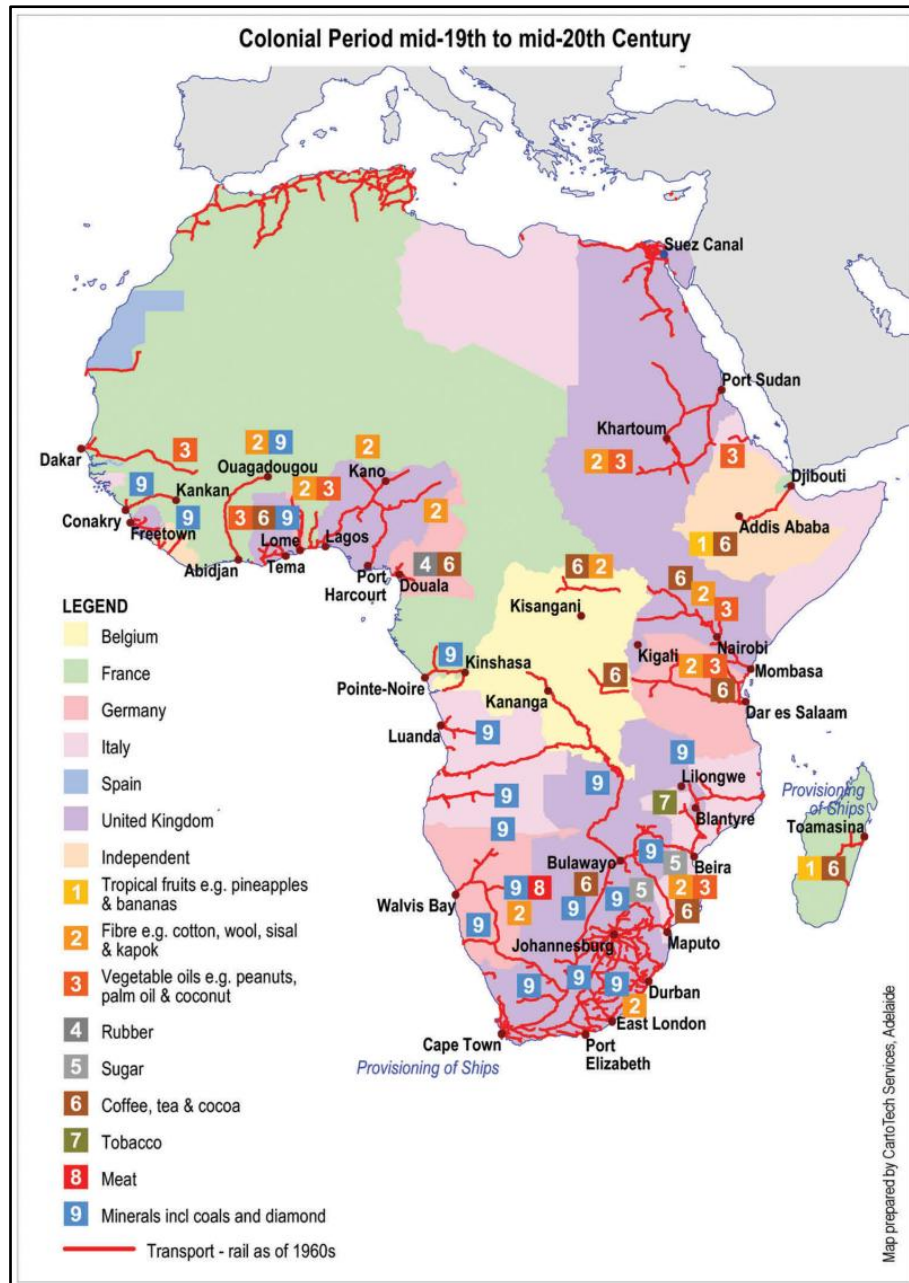


Figure 4.20: Colonies, export crop production and railroads, mid-nineteenth to mid-twentieth century (Bjornlund *et al.*, 2020: S23).

Western perspectives of African soils were further biased by racial divisions, in that: “prejudice and ignorance often prevented information exchanges, [and] it was said [by Europeans] that African soils were worn out by African smallholders’ agricultural ‘mining’ of their fertility, and destroyed by trampling of their livestock” (Showers, 2006:118, 120). Consequently, colonial soil conservation policies were interventionist in local farming practices and marginalised LSK (Anderson, 1984). Racialized colonial administration and its biased

‘scientific expertise’ were implicit to the production of these views (Delius & Schirmer, 2000; Ogen, 2006; Showers, 2006; Kreike, 2008; Stull *et al.*, 2016; Chassé, 2019). Grove (1997:179) further argue that western colonial values imposed on African land and soils involved:

a growing exploitation of the landscape for commodity production, and a corresponding erosion in customary controls and common property rights or conventions; [...and spread...] a European capitalist system over the globe with the corresponding penetration of a Western economic process. [...] [Furthermore,] the gazetting of game reserves, the enclosure of common grazing lands, the draining of marshlands, the destruction of indigenous irrigation systems and the creation of new ones have all interacted in a significant way with social change, [and] social exclusion. [Yet] the ecological details of direct colonial intervention in the production process have received remarkably little attention.

Certain biased aims of WSS can be perceived in soil surveys. The chief purpose for colonial surveys in Africa was to understand soil conditions with the aim of increasing the production of cash crops such as coffee, tea, cotton, tobacco, sugar, cocoa, palm oil and groundnuts (Ssali, 2000; Showers, 2006; Roessler *et al.*, 2022). Importantly, the colonising process in Africa allocated large tracts of the best agricultural land to European settlers for intensive cropping; while local inhabitants and their extensive traditional practices of shifting cultivation were confined into ‘native reserves’ – often areas of poor soils (Stocking, 1985; Kreike, 2008; Critchley & Netshikovhela, 1998; Bjornlund *et al.*, 2020; Radcliffe, 2022). Roessler *et al.* (2022:5) further highlight that: “[i]n settler colonies [...] the government banned African cash crop farming to reduce competition and drive indigenous farmers to work on European plantations.” These means of capitalist production were thus inherently racist (Stull *et al.*, 2016; Grosfoguel, 2020).

In post-independence Africa it can be argued that these power relations between Africa and the global North, remained largely unchanged. Dea and Scoones (2003:467) argue that “[i]nternational influences continue to play an important role, both setting the agenda and framing the debate [on the management of African soils].” For example, powerful global North actors like the International Monetary Fund (IMF) and World Bank, heavily influenced land policies and practices in Africa through the implementation of structural adjustment programmes (SAPs). In the 1980s, SAPs were economic reforms promoted as a means to manage the spiralling international debt-trap of these African countries, by increasing economic output and also consequently alleviating poverty. These SAPs were enforced by

onerous loan conditions that required the (often authoritarian) introduction of market and policy instruments, such as: trade liberalization, privatization of state-owned enterprises, and decreased expenditure on the public sector. Nevertheless, the social and environmental impacts of the SAPs were heavily criticized as predominantly negative. These included increased financial and food insecurity, increased gender inequality, resource exploitation, and land degradation caused by: deflationary policies and the removal of basic subsidies, trade liberalisation, land commercialisation, increased dependence on commodity exports, and defunded public institutions and cutbacks in agricultural funding (Sahn & Arulpragasam, 1991; Kessler & van Dorp, 1998; Gladwin, 2002; Gibson, 2004; de Jager, 2005; Mogues *et al.*, 2015; Graeub *et al.*, 2016; Badiane *et al.*, 2020). It has specifically been argued that structural adjustment programs contributed to decreases in soil fertility (Heerink, 2005; Benjaminsen *et al.* 2010). Local soil science research efforts were however predominantly directed toward increasing the productivity of commercial cash crops (Sanchez, 2019). Although responses vary by context, some cases demonstrated a vicious downward cycle or “agricultural involution”, where due fertilizer price increases and consequent soil nutrient mining, poverty increased (Scoones, 2001:42). Ibhawoh (1999:158) further contends that while African states were authoritarian in implementing unpopular SAPs, it was the IFIs (International Financial Institutions) “[who] set the tone for authoritarianism and human rights violations by insisting on politically difficult conditionalities in the implementation of economic reforms”. Thus, beyond the colonial era, western paternalism and extractivism in Africa continued unabated (Bjornlund *et al.*, 2020; Reinsberg *et al.*, 2021).

Further to this, Gobezie *et al.*, (2021) state that the global North, by way of financial and technical aid in Africa, established and directed agricultural development projects and associated soil survey centres. Koch and Weingart (2016) criticise such foreign aid as creating epistemic dependence. Gonzalez *et al.* (2010:1) also highlight this epistemic power imbalance by stating: “[t]here is a lack of information concerning the history of soil science in developing countries.” Moreover, Hartemink’s (2002) research draws attention to the fact that more soil science research is published about Australia, than about all of Africa – while Australia’s then population was 2% of Africa’s (Statista, 2024a; Statista, 2024b). Similarly, Turshen (2002) argues that, while acknowledging genuine challenges in Africa, the World Bank exerts inordinate influence over research agendas and data generation, and perpetuate negative depictions of Africa – thus reinforcing a simplistic epistemological trap of African failure. The

result of the foregoing examples is that, by way of epistemic imperialism, the contributions of soil scientists and indigenous peoples in the global South are quietly omitted from the canonical development of the discipline.

A recent example of white European men dominating the construction of soil knowledge in and about Africa is *The Soil Atlas of Africa* (Dewitte *et al.*, 2013), produced by the Joint Research Centre of the European Commission. Of the 18 authors there are: four black African men, one Arab man, one white woman, ten white European men, and two are indeterminate (but are most likely a white European man and a black African man). Thus, the authorship comprises: 94% men, approximately 60% white European men, and less than 30% black African men. See Appendix 4.4 for details of this analysis. In this instance, considering that African soil scientists who live on, work with, and study African soils are in the minority in producing this international publication on African soils – a form of epistemic extractivism could be said to be taking place (Grosfoguel, 2020). Moreover, a superior and paternalistic attitude can be perceived in quotes in this atlas, such as: “many African countries lack the fundamental [soil] knowledge base on which to base policy and land management decisions” (Dewitte *et al.*, 2013:140). This continental-scale map was preceded in the 1970s by the similarly global-North-led *World Soil Map* of the UN’s FAO (United Nations Food and Agriculture Organisation) (Showers, 2005; Hartemink *et al.*, 2013). Selcer (2011) argues that this map: “embodie[d] the values of universal knowledge legible only to an elite class of cosmopolitan experts”, externally defined the soils of Africa for decades, and served as natural resource surveys. King and Granjou (2020:39) specifically argue that “soil maps materialize struggles for the imposition of value-laden views of what soils are, who soil experts are, and what knowing and governing soils means.”

The focus of the discussion now shifts to the exploring similar biases present in WSS, as evidenced in South Africa.

The history of academic soil science in South Africa is similar to the discipline's overarching history: white male academics dominated the development of the field. Turner (2013) acknowledges notable soil scientists (all white men) in the development of the South African discipline, namely: Beater; De Villiers; Louw; Loxton; MacVicar; Rosenstrauch; and van der Eyk. The seminal texts of the South African soil science canon were also written by white men, particularly: van der Merwe's 1940 *Soil Groups and Sub-groups of South Africa* and Malherbe's 1964 *Soil Fertility* (Joubert, 1977). As the first president of the Soil Science Society of South Africa (SSSSA) in 1953, van der Merwe's pioneering classification work is also acknowledged in the first edition of the South African national soil classification as the basis for the system (MacVicar *et al.*, 1977; Barbosa & Poggere, 2016). Laker (2003) further notes the lasting impact of van der Merwe's 1940 work on the second edition of the South African national soil classification scheme. In the 'Historical Background' to the first edition of the South African national soil classification, MacVicar states that initially investigations were conducted into South Africa adopting the USDA scheme, but it was found unsuitable for local soils (MacVicar *et al.*, 1977). It was due to the relatively unique South African soils that neither the USDA nor FAO schemes were adopted at the outset. Laker (2003) elaborates that the FAO's and USDA's soil classifications were primarily based off two of the world's three major soil regions, namely the high latitudes of the northern hemisphere (well-studied in Europe and North America) and the humid and sub-humid tropics (as studied by Europeans). Neglected however, was the world's third soil region: lying in the mid-latitudes between approximately 20° and 35°. This includes all of Southern Africa, most of Australia, and major deserts in the Northern hemisphere (Laker, 2003). Thus, while South African soil science was less defined by Europeans than tropical African soils, the canon was principally established by white men. In shaping the local academic canon, these men's perspectives remain influential today.

In a segregated apartheid South Africa, it is similarly of little surprise that there are no people of colour in Figure 4.21's group photo of the delegates of the 1978 congress of the Soil Science Society of South Africa (SSSSA). Notably, this is a year after of the first official soil classification system for South Africa was published (MacVicar *et al.*, 1977). Unsurprisingly,

the surnames of all the contributors²² are distinctly not African, neither are any in the 1991 second edition²³. This trend has seemingly remained unchanged in the third edition of 2018²⁴.



Figure 4.21: Group photo of the delegates of the 1978 SSSSA congress (Source: SSSA, 2021).

Also notable is that sponsorship to develop the 2018 South African soil classification system, was provided by companies with vested commercial interests in soil science for productive agricultural ends (SCWG, 2018:6):

Numerous other organizations²⁵ have, over an extended period, made contributions or provided sponsorship to formal and informal field site examinations and discussion. [...] These have helped to shape the development of concepts, and hence the ultimate publication of this Revised Edition of the South African Soil Classification System.

Thus, these few sponsors influenced the epistemology of this national classification system. Another example in this vein is Paterson *et al.*'s (2015:2) report on a national workshop where “participants included researchers, academics, government officials, private consultants and industry representatives”, who issued a call for a national task force on soils information.

²² Macvicar, C.N.; de Villiers, J.M.; Loxton, R.F.; Verster, E.; Lambrechts, J.J.N.; Merryweather, F.R.; le Roux, J.; van Rooyen, T.H.; von M. Harmse, H.J. (MacVicar *et al.*, 1977)

²³ Macvicar, C.N.; Bennie, A.T.P.; Villiers, J.M.; Ellis, J.; Fey, M.V.; von M. Harmse, H.J.; Hensley, M.; Lambrechts, J.J.N.; Bruce, R.W.; Dohse, T.E.; Eloff, J.F.; Grey, D.C.; Hartmann, M.O.; Idema, S.W.J.; Laker, M.C.; Merryweather, F.R.; Michael, D.; Schloms, B.H.A.; Schönau, A.P.G.; Snyman, K.; Van Niekerk, B.J.; Verster, E.; Loxon, R.F.; Meyer, J.H.; Paterson, D.G.; Schoeman, J.L.; Scotney, D.M.; Turner, D.P.; Van Rooyen; T.H. & Yager. T.U. (SCWG, 1991).

²⁴ Turner, D.P.; Booyens, H.B.; Clarke, C.E.; du Plessis, M.J.; Ellis, F.; Koch, J.; le Roux, P.A.L.; Paterson, D.G.; van der Waals, J.H.; van Deventer, P.W. van Tol, J.J.; van Zijl, G.M.; Verster, E. (SCWG, 2018).

²⁵ Hortgro (association for the deciduous fruit industry), Profert (fertilizer manufacturing company), SA Cane Growers Association (association for commercial sugarcane growers), Vinpro (association for commercial viticulturists), Omnia Fertilizers (fertilizer manufacturing company), Netafim (multinational irrigation company), NWK (commercial agricultural services and products, *inter alia*: financing, mechanisation, trading, agrochemicals, logistics etc.)

Nevertheless, there are at least 4 million South African subsistence farmers (Aliber & Hart, 2009; Rogan, 2018) – whom are not represented as stakeholders in these projects. Thus their interests, viewpoints and soil knowledges were, and remain, marginalised. This is problematic, as Obalum *et al.* (2012:6) point out: “African farmers tend to be alienated from any science-oriented agricultural production system that is not rooted in their farming culture and to which their indigenous knowledge does not make any contribution.” Moreover, Delius and Schirmer (2000:719) argue that science-led state-interventionist soil policies during apartheid also “provoked bitter resistance in many African communities.” The environmental legacy of apartheid policies harmed both black and white farmers: by forcefully relocating high densities of black South Africans onto marginal lands, resulting in soil degradation; while subsidising white South Africans’ overuse of harmful chemicals and soil compacting heavy machinery. Results thereof remain in the degraded lands and marginal livelihoods (Stull *et al.*, 2016).

Nevertheless, a high-level appraisal of prospectuses and soil science degrees offered by South African universities, indicates little attempt toward Africanisation. The Soil Science Society of South Africa (SSSSA) lists the below eight universities as having dedicated soil science departments/undergraduate qualifications (SSSSA, 2022).

- Stellenbosch University (SUN)²⁶,
- North-West University (NWU)²⁷,
- Tshwane University of Technology (TUT)²⁸,
- University of the Free State (UFS)²⁹,
- University of Limpopo (UL)³⁰,
- University of Pretoria (UP)³¹,
- University of Venda (UniVen)³² and,
- University of KwaZulu-Natal (UKZN)³³.

²⁶ SUN: <http://www.sun.ac.za/english/Documents/Yearbooks/Current/AgriSciences.pdf> Accessed: 14 February 2022.

²⁷ NWU: <http://studies.nwu.ac.za/sites/studies.nwu.ac.za/files/files/yearbooks/2022/12-FNAS-UG-2022.pdf> Accessed: 14 February 2022.

²⁸ TUT: https://www.tut.ac.za/ProspectusDocuments/2022/Dip_Crop_Production_2022.pdf Accessed: 14 February 2022.

²⁹ UFS: <https://www.ufs.ac.za/docs/librariesprovider44/faculty-programmes/2022/natural-and-agricultural-sciences-2022.pdf> Accessed: 14 February 2022.

³⁰ UL: <https://www.ul.ac.za/application/downloads/PSAE%20WEBSITE%20INFORMATION%20-UNDERGRADUATE%20MODULES.pdf> Accessed: 14 February 2022.

³¹ UP: <https://www.up.ac.za/yearbooks/2022/pdf/faculty/SCI?content=full> Accessed: 14 February 2022.

³² UniVen: https://www.univen.ac.za/wp-content/uploads/2021/07/Univen_2022_Undergraduate_Student_Brochure.pdf Accessed: 14 February 2022.

³³ UKZN: <https://ukzn.ac.za/wp-content/uploads/2022/01/UKZN-UG-Prospectus-2022.pdf> Accessed: 14 February 2022.

University prospectuses provide a brief module description. Importantly, the course outlines in official prospectuses are legally binding on universities. This indicates accreditation by the Council for Higher Education (CHE), registration with the South African Qualifications Authority (SAQA), and approval by the DHET (Department of Higher Education and Training) (DHET, 2016). In these universities' prospectuses (see footnotes #25-32), the course outlines of the relevant departments make no mention of the search terms 'Africanisation', 'indigenous knowledge', nor 'ethnopedology', in their soil science curricula. Nevertheless, there are numerous other modules/subjects in these prospectuses that make explicit mention of indigenous African knowledge in, for example: botany, urban and regional planning, physics, and even an undergraduate degree in IKS. This is despite, for example, the scientific study of traditional and indigenous soil knowledges, or ethnopedology, being an area of significant African and international academic research since the 1980s (Williams & Ortiz-Solorio, 1981; Nyamapfene, 1983; Tabor, 1992; Ettema, 1994; Talawar & Rhoades, 1998; Barrera-Bassols & Zinck, 2000; Birmingham, 2003; WinklerPrins & Barrera-Bassols, 2004; Fairhead & Scoones, 2005; Magoro & Masoga, 2005; Martínez-Villegas, 2007; Materechera, 2008; Fairhead & Leach, 2009; Roskrige, 2011; Nethononda & Odhiambo, 2011; Frausin *et al.*, 2014; Capra *et al.*, 2015; Rankoana, 2017; Buthelezi-Dube *et al.*, 2018; Manyevere *et al.*, 2020; Ekobi *et al.*, 2023; Pérez-Rodríguez *et al.*, 2023). Thus, it can be seen that Africanising curriculum transformation is under way, and needs to be further advanced in diverse disciplines, including soil science.

Importantly, studies have found that meaningful integration between LSK and soil science result in more sustainable soil conservation initiatives (Norton *et al.*, 1998; Oudwater & Martin, 2003; Peña-Venegas, 2016; Bapfakurera & Nduwamungu, 2020). Nevertheless, little to no mention is made of IK in comprehensive review-type articles of advances in South African soil science, concerning such topics as: soil crusting (Laker & Nortjé, 2019a), soil physics and soil water management (Bennie & Hensley, 2004), soil erosion, soil conservation, land suitability evaluation and land use planning (Laker, 2004; Baade *et al.*, 2024), soil health (Louw *et al.*, 2014), soil quality (Mills & Fey, 2004; Schoeman & van Deventer, 2004; Daniell & van Tonder, 2023), soil classification (Lambrechts & MacVicar, 2004; Turner, 2013; van Zijl *et al.*, 2020), soil salinity in irrigation (Muller & van Niekerk, 2019), rangeland soil quality and management (Kotzé *et al.*, 2019), conservation agriculture (Swanepoel *et al.*, 2017; Nortjé & Laker, 2021; Strauss *et al.*, 2021), soil biology and biochemistry (Haynes & Graham, 2004),

subsurface soil compaction (Laker & Nortjé, 2019b), soil chemistry (Fey & Manson, 2004), soil fertility (Barnard & du Preez, 2004), soil mineralogy (Bühmann *et al.*, 2004) and hydropedology (van Tol, 2022). It can thus be seen that, by in large, South African soil science also adheres to the epistemic of the discipline as a whole: western and positivist – with its attendant biases.

Hartemink (2015:584) admits that “[w]e [soil scientists] have better tools for quantifying soil properties and processes, although sometimes the developments [...] appear to outpace the development of sound theory.” Thus, soil scientists seem to find themselves yet again where they were in the 1980s: not leading the expansion of the theoretical discourse about soils. Rather, social scientists are tackling postmodern intersectional questions of soils, decolonisation, climate injustice, IKs and the ‘more-than-human’ (de la Bellacasa, 2019; Krzywoszynska, 2019; Salazar *et al.*, 2020; McElwee, 2021; Friedrichsen *et al.*, 2022; Granjou & Meulemans, 2023; Kallio & LaFleur, 2023; Davidson & da Silva, 2024; LeVasseur, 2024). Carter *et al.* (2021:963-4) thus conclude by specifically highlighting the risk of a lack of dialogue, inclusivity and diversity in the discipline:

The history of soil science, [...] has been told through an incomplete lens, obfuscating and purposefully removing the contributions of Indigenous peoples and other groups persistently excluded and marginalized from the dominant narrative. This narrow view threatens the ability of soil science to contribute to solving some of our most pressing environmental and social challenges. [...] Redressing the current state of [epistemic and] social inequity in soil science requires an acknowledgment of historical events that gave rise to our discipline today and shape our current institutions. Western soil science is rooted in colonization, manifest destiny, and westward expansion. This has led to the displacement of Indigenous people [and marginalisation of their local knowledges].

Evidenced in the preceding sets of arguments, is that, on the whole, western soil science and its privileged western enlightenment-rooted positivist epistemic, regard soil as a ‘mechanistic’ ‘object’. Having imposed such an exclusive definition upon soil, the ways in which soil is apprehended and responded to, become directed by that definition. The ensuing ontological superiority then precludes other ways of knowing, and validates the moral right for soil ‘objects’ to be ‘mechanistically’ manipulated to meet the desired ends of such a worldview (e.g. efficient production for sustained profit). The unintended (environmental and social) consequences of such approaches have become manifest. It remains to be seen that – soil

science as it conceives itself of as a discipline – has truly embraced its inherent relationships with the social world, let alone the indigenous social world. So, while humans are considered a biotic factor that impact soils, the narrow definition of soils precludes considering how soils affect people, and how reciprocally, a peoples' culture (as shaped by their lives with their soils) affects the soil. It thus becomes apparent that there is space for the discipline to reflect on its history and epistemic stance. Besides, the presented biases do not serve the well-intentioned aims of the discipline. Meaningful engagement with diverse LSK (their Kosmos, Corpus, and Praxis) can however contribute to fruitfully expanding modern soil understandings. In view of these shortcomings, and the potential to address them by way of the discipline's meaningful engagement with LSK, the discussion now explores the epistemics of indigenous soil knowledges and their inherent value.

4.5 Local Soil Knowledges and Ethnopedology

The forgoing arguments have evidenced and critiqued the mono-episteme of WSS. This section presents alternative, diversifying and complementary LSK³⁴. Firstly, context for comparison is provided by a brief outline of indigenous epistemologies. Specifics of the marginalisation of LSK by WSS follow. The section then turns to a discussion of the academic literature on ethnopedology – a means by which LSK have been researched. The types, models and approaches, merits and limitations of such ethnopedological studies are then outlined. Examples of LSK are provided and discussed for comparison with WSS. This is followed by arguing that WSS's meaningful engagement with LSKs in a dialogic and participatory approach complements, expands and diversifies modern soil understandings. The section concludes with the assertion that, to broaden the discipline's traditional epistemic, meaningful transformation of tertiary soil science curricula is essential, with integration of LSK being a route to embrace diverse epistemologies.

³⁴ In consideration of terminology, Oudwater and Martin (2003) deemed 'local' as the most fitting adjective to describe what has also been called indigenous, traditional or folk knowledge. They reasoned this choice, as the connotation of local includes the dynamism of place-based knowledge systems, whereas the adjectives traditional or indigenous could mistakenly imply static, old or staid – which these local knowledge systems are not. The academic debate between these terms (see for example Sillitoe, 1998b) is anyhow beyond the scope of, and inconsequential to, this research. The aforementioned terms are thus used interchangeably here, although 'local' is preferred.

4.5.1 The Study of Local Soil Knowledges

Descola (2009:xiv) and Davidson and da Silva (2024:3) (respectively) adroitly underscore that WSS is indeed one amongst many historically and geographically located worldviews of soils:

As if, by a miracle of universal reason, the subject matter of pedology (the word itself only dates from the end of the 19th century) had been universally apprehended as such since the dawn of times [and forevermore], as if all humans had an intuitive foreboding of the existence of the soil as a class of autonomous facts clearly demarcated within the perceptual flux by the means of which we continuously become aware of our environment. This is highly unlikely. A more plausible alternative is that, before the great Modern shift which instituted a separation between nature and culture, soil figured according to [local] circumstances, and for such or such a person in particular, sometimes as a sensation under bare feet, sometimes as a potentiality to grow a specific kind of crop, sometimes as a mass to dig out when building an irrigation ditch, sometimes as a pigment for body painting, in short, as qualities referred to persons and their experiences, not as a material abstraction referred to a quantifiable abstraction.

[S]oil is not merely an ahistorical given, something that exists in all times and places in the same way, but instead something formed and reformed through the actions of humans and the impact of non-human forces.

Thus while WSS has dominated epistemic normative narratives, there are contrasting (African) ways of knowing. Hamminga (2005:57) in particular codify traditional African epistemology as follows: “[Firstly,] knowledge is not acquired by labor but ‘given’ by the ancestors. Second, it is immediately social: not ‘I’ know, but ‘we’ know. Thirdly, knowledge is not universal but local tribal: other tribes have different knowledge. Knowledge has its ‘biological variations’ like all other things in nature.” Thus, while the western scientific epistemic values abstraction, possession and the individual, African IKs value a located connected collective. While, LSK are not monolithic in their details, indigenous cultures across the world seemingly share many fundamental worldview values; in South American LSK, for example (Peña-Venegas *et al.*, 2016:8) details that:

The indigenous people of the Middle Caquetá River region have a complex view of the world. They understand living and non-living elements as being composed of physical and spiritual components. All elements, including humans themselves, are equally important parts of a unique unit, the world [i.e. collective]. Because all components are equally important, they cannot be isolated from one another [i.e. connected]. In this way, soil does not exist per se. It is part of a place [i.e. located] that includes also other elements such as vegetation, water sources, landscape, and animals that live there in an integral way.

Despite these tens of thousands of years of indigenous soil understandings and management, LSK has historically been marginalized (Barrera-Bassols & Zinck, 2003). Since the advent of ‘western’ soil science – its methods and taxonomies – indigenous soil knowledges have largely been ignored, usurped and even suppressed, in favour of “modern [western]” practices and technologies (Dea & Scoones, 2003:463; Iloka, 2016). Colonialism and the attendant industrialisation and agricultural ‘revolutions’, have aggressively displaced local soil and agronomic knowledges in favour of ‘production efficiency’. In particular LSK has been eroded and displaced by: cash crops, western methods in farming and technical soil science (Krasilnikov & Tabor, 2003; Bargout & Raizada, 2013, Stull *et al.*, 2016). Fowler and Rockstrom (2001:93) draw attention to examples of *how* it was that African indigenous soil knowledges and technologies were forcefully replaced by European farming methods:

Land invasions and displacements, the introduction of technologies more suited to European conditions, and increased use of the mouldboard plough and hand hoe slowed and almost halted [existing African agricultural technologies]. In recent decades farmers have in some areas regained security of tenure, recognised the potential value of indigenous knowledge, and begun to understand the degradation caused by soil inversion and other ‘modern’ technologies.

Grove (1997) further points out that in the late eighteenth century, imported European farming methods were criticized as ill-suited compared to local indigenous practices and for damaging South Africa's semi-arid Cape environment. Krasilnikov and Tabor (2003) similarly provide examples from Senegal, Saudi Arabia and the USA where, disconnects between traditional and scientific approaches to soils have led to poor land management decisions, resulting in wasted resources and significant economic problems for local communities.

Largely however, soil scientists have historically deemed LSK as “inferior and backward” (Ettema, 1994:1). It is thus conspicuous that Dokuchaev based his initial studies and classifications on vernacular Slovenian soil names (Krasilnikov & Tabor, 2003). It is overlooked that Lomonosov, Siburtzev and Dokuchaev’s soil classifications use well-established peasant Russian, Ukrainian and Polish soil terms, such as: *chernozem*, *solod*, *podzol*, *solonetz* and *rhendzina*. LSKs have also provided other central concepts of soil units and catenae which are integral to modern soil science (Lag *et al.*, 2008; Krasilnikov *et al.*, 2010). Krasilnikov *et al.* (2010) conclude that modern scientific soil taxonomies were developed from three main sources, namely: folk soil knowledge, empirical soil study, and scientific theories.

It is then remarkable that, incidences of modern-day indigenous soil knowledge are well correlated with both biodiversity and linguistic diversity (Barrera-Bassols & Zinck, 2002). Reyes-Sánchez & Irazoque (2022:7) quantify it thus: “Indigenous Communities, who constitute 5% of the population and who preserve 21% of Soil that we all need to survive and who are paid back with 15% of the world’s poverty and whose presence in science is almost non-existing.” Ogen (2006) asserts that broad generalizations and incorrect assumptions, such as the neo-classical charges of indolence, barbarism, subsistence and infertile soils, stem from a fundamental disregard of the socio-cultural factors influencing pre-colonial African soil management. The results of such systemic marginalisations have become progressively apparent as part of the global issues of ecocide and epistemicide (Kotlyakov & Komarova, 2007; de Sousa Santos, 2014; Grosfoguel, 2015; Le Grange, 2021). de Sousa Santos (2016:243) further makes the indictment: “[t]he epistemological privilege that modern science grants to itself is thus the result of the destruction of all alternative knowledges that could eventually question such privilege”. Rather than being denigrated or ignored, LSK should be recognised as a valuable facet of human understandings and conservation of soils. The discipline of soil science should increase their efforts to include indigenous communities as equal co-researchers, and thereby expand the discipline’s otherwise biased epistemic (Reyes-Sánchez & Irazoque, 2022), and by extension, develop ‘located’ tertiary curricula. Unfortunately, the few studies in the last decade which compiled priority research themes sourced from a communities of soil scientists, entirely neglect LSK research (Adewopo *et al.*, 2014; Rodrigo-Comino, 2020; Cimpoiasu *et al.*, 2021; Francis & Tóth, 2022).

LSKs are in any event important and valuable as they vary by, and are appropriate to, their locale (Talawar & Rhoades, 1998). LSK are both practical and embedded in complex IKS that extend beyond the domain of soils (Crane, 2002; Erickson, 2004; Sandor *et al.*, 2006). Ethnopedology, in turn, is the academic study of such socially situated LSK. As a term, ethnopedology is often used synonymously with terms such as: traditional, folk, local, indigenous, farmers’ and peoples’ soil knowledge systems. As a research area, ethnopedology is a multi-scaler transdisciplinary domain of research which bridges the social and the natural sciences in the realm of land and soils (Barrera-Bassols & Zinck, 2003). It emerged as a sub-discipline of ethnoecology, which itself was first articulated by Harold Conlin in 1954. In essence ethnoecology focuses on studying human understandings of local environments and ecosystems, and their ensuing dynamic relationships and interactions. These can include *inter*

alia: direct experience, trial and error, dynamic equilibria, intergenerational knowledge, beliefs, spiritual meanings, symbolism, representations, cultural referents, and socio-cultural traditions. LSK, though often deemed empirical, also involve scientific processes and experimentation, sharing traits with modern soil science despite significant differences in scope, scale, and methodology (Sandor *et al.*, 2006; Krasilnikov & Tabor, 2009). The term ethnopedology was accordingly coined in 1981 by Williams and Ortiz-Solorio. Figure 4.22, a Google Ngram of the frequency of the term, shows an initial increase in the 1980s, followed by significant growth in the late 1990s and early 2000s. This is followed by a decline; although a recent up-tick is also evident. The available ethnopedological literature reviewed here affirms this trend.

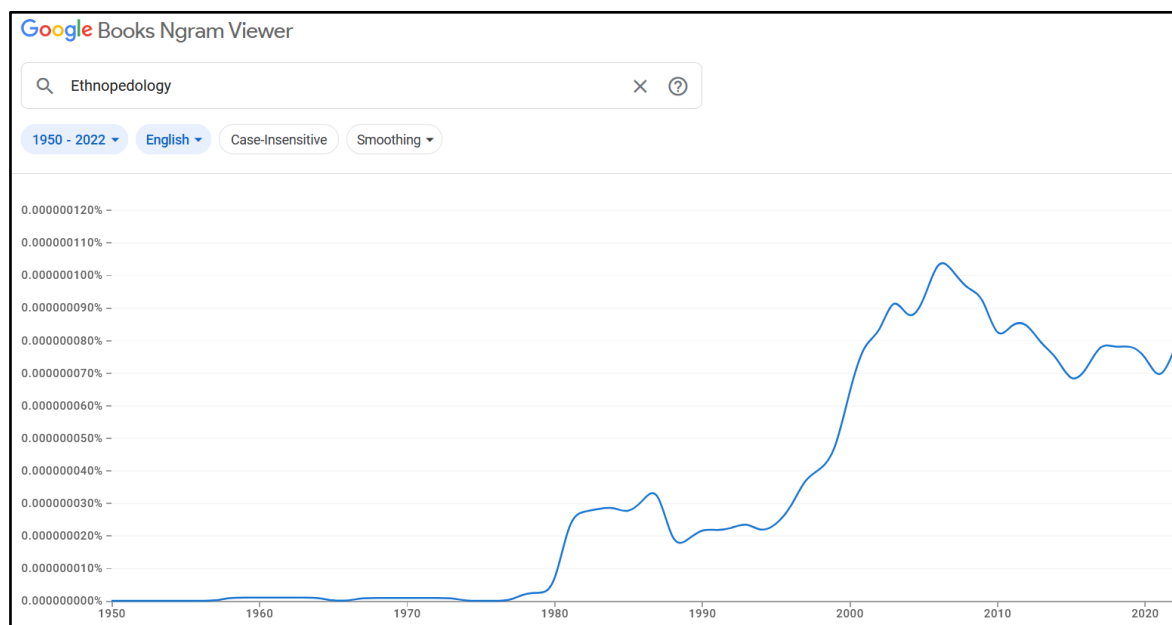


Figure 4.22: Google Ngram graph of frequency of the term ‘Ethnopedology’, between 1950 and 2022 (Google Ngram, 2024).

Ethnopedology researches the diversity of human understandings of, and the ensuing dynamic relationships with, local soils. LSKs are deep, comprehensive, and dynamic bodies of understanding, shaped by multi-generational interaction with the land and its processes. Ethnopedology’s situated research approach thus acknowledges the inextricable socio-cultural embeddedness of this soil knowledge. Importantly, by taking this approach, it also seeks to surface that there are underlying economic, infrastructural, cultural, and social value

judgements, which affect how soils may be differently managed (Williams & Ortiz-Solorio, 1981; Rist & Dahdouh-Guebas, 2006; Martínez-Villegas, 2007; Krasilnikov & Tabor, 2009; Capra *et al.*, 2015; Pérez-Rodríguez *et al.*, 2023; Teuber, 2022). This contrasts with the epistemic of WSS, which holds the belief that its universalising epistemic exists independently of any socio-cultural influences, and that it is the sole arbitrator of, and path to, true and meaningful knowledge (Grenz, 1996). The previous sections have argued that such assumptions and their implicit biases are problematic and limit the discipline. It is contended here that, unlike modern soil science, LSK is inter-generationally tested in a locale, and is thus more holistically integrated within that culture and environment (Sandor *et al.*, 2006). Capra *et al.* (2015:2) supports this by arguing that ethnopedology recognises that “pedodiversity is strongly related, not merely to physical-chemical behaviour and soil taxonomic properties, but also to anthropic management, historical uses, cultural practices and, indeed, the whole of [local] indigenous knowledge.” Thus, ethnopedology seeks to understand LSKs beyond ‘technical objectivities’.

To forward these understandings, the ethnoecological model, or K–C–P complex, is a social theory that has been applied in ethnopedology. It considers IKS from the perspective of three integrated domains, namely: Kosmos (symbolic/beliefs), Corpus (cognitive/knowledge) and Praxis (management/practice) (Sandor *et al.*, 2006; Toledo, 2022). Barrera-Bassols and Zinck (2003:173) argue that this schema meaningfully articulates local soil wisdom by holistically integrating “sacred and secular features, knowledge and experience, facts and values, and matter and mind” (see Figure 4.23). Applying the K–C–P schema to ethnopedological studies has demonstrated that the majority focused primarily on practical soil management (practices), followed by cognitive understandings (knowledge), with the least research considering the symbolic meanings of soils (beliefs). This is consistent with the fact that the majority of ethnopedological studies *compare* and *validate* LSK and local soil classifications *against* WSS classifications. Such an approach can be problematic, as scientific soil knowledge implicitly becomes the benchmark, rather than fostering a dialogue between equal epistemics (WinklerPrins & Barrera-Bassol, 2004; Barrera-Bassols *et al.*, 2006).

Another analytical tool – the ResourceComplex – has been proposed as a means to identify and analyse the dimensions and values attached by different social actors to a local soil. In analysing

the resultant complex networks and interactions that exist between resources, (including their uses and modifying elements), mutualistic research and understanding can be fostered. However, problematically, considerations of economic efficiency often overshadow cultural considerations (Teuber, 2022). Here too, there can problematically remain an implicit epistemological superiority of western soil classifications (and the overriding values of economic efficiency) when compared to local soil classifications. For true epistemic and ontological equality to be achieved, such research needs to become a conversation between worldviews (Gray & Morant, 2003; Barrera-Bassols *et al.*, 2006; Toledo, 2022). When executed thoroughly, ethnopedology's inclusive epistemic stretches the traditional western scientific conception of soils. In this respect, Barrera-Bassols *et al.* (2006:124) argue that:

by integrating facts, meanings and values, the ethnoecological approach is guided by ethical and moral concerns regarding the sustainable management of natural resources. It is particularly concerned with the self-empowerment of localities and challenges the supposed neutrality of the outside observer.

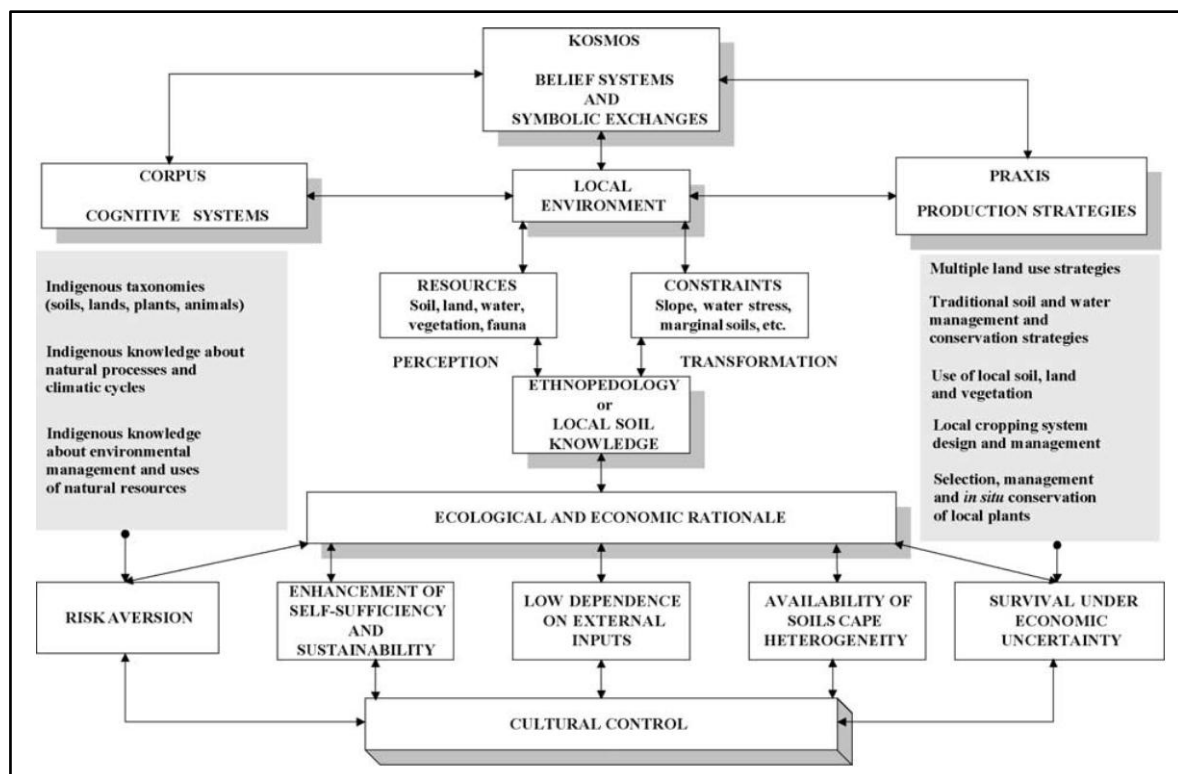


Figure 4.23: The scope of ethnopedology as regarded through the ethnoecological K–C–P schema (Barrera-Bassols & Zinck, 2003).

Having established the how modern research has approached LSK to apprehend them, the chapter now turns to the synergistic potentials between local and western soil knowledges.

4.5.2 Synergies of Local and Scientific Soil Knowledges

Ethnopedology is fundamentally an inter-disciplinary area of research, which aims to: “combin[e] cognitive resources from different fields in order to solve problems that cannot be solved adequately within any of the involved fields alone” (Andersen, 2016:6). Barrera-Bassols and Zinck (2003) explain that ethnopedological studies have evolved from the purely ethnographic, beyond the simply comparative, and are tackling integrated understandings of local soils – such that locally sustainable soil projects can be realised. Ethnopedology is accordingly often a collaboration between soil scientists, anthropologists and geographers; nevertheless it also can usefully include, *inter alia*: sociologists, economists, agronomists, development specialists, historians, ecologists, botanists, linguists, archaeologists, political scientists, engineers and local communities. At the same time, such interdisciplinary research requires significant efforts from researchers in the obligation to meaningfully communicate outside of, and understand beyond, their original discipline of training – and most importantly – even worldview (WinklerPrins & Barrera-Bassol, 2004; Martínez-Villegas, 2007; Andersen, 2016; Teuber, 2022). Barrera-Bassols and Zinck (2003:177) further contend that: “by taking into account local values and symbolic meanings rather than distorting indigenous knowledge by imposing a western scientific model on it, the limits of both epistemologies [western and local indigenous] are accepted and their synergies enhanced.” To this end, Huynh *et al.* (2020) conclude that there is a need to integrate social science methodologies in LSK research.

There are however several limitations that hinder the effective integration and application of LSK. A chief challenge is the difficulty of developing and implementing broader soil conservation policies based on their highly localized nature (Krasilnikov & Tabor, 2003; De Donà, 2022). The oral tradition of transmitting IK can also limit LSK’s availability and accessibility. Such traditions are often more active between the elderly, who may also perceive scientific information as too technical and difficult to engage with. Other hindrances include: out migration of youth, mistrust of outsiders and unwillingness to share, and commitments to transmission by observation and practice (Akullo *et al.*, 2007; Basdew *et al.*, 2017; Ebhuoma & Simatele, 2017; Dlamini, 2024). While the potential for LSK to support sustainability agendas remains largely underutilized, neither should they be romanticized as a panacea. They may be less systematic than scientific knowledge and could be inadequate in rapidly changing contexts (Bredlid, 2009). Methodologies for the meaningful integration of IK are also demanding (Tuhiwai Smith, 2008). Therefore, interdisciplinary collaboration in ethnopedology

is often hampered by individual scientists' willingness to cooperate and step beyond their epistemic, paradigmatic and methodological comfort zones (Teuber, 2022; Sigl *et al.*, 2023).

Nevertheless, the literature widely agrees that LSK are of great practical value in forwarding sustainability goals. Advantages include: nuanced long-term understandings of (and adaptations to) local conditions, a holistic approach with a view to sustainable livelihoods, flexibility, low external inputs, time-tested, and socio-culturally integrated (White & Jickling, 1995; Barrera-Bassols & Zinck, 2002; Oudwater & Martin, 2003; WinklerPrins & Sandor, 2003; Buthelezi-Dube *et al.*, 2019; Manyevere *et al.*, 2020). Consequently, Sandor *et al.* (2006:43) argue that the reason for such sensitivity to subtle variations in one's environment, is due to the: "special relationship [between] humans [and] land [which] develops when multiple generations become rooted in a place." Notably, both WSS and LSK holders classify soils for the purposes of communication, understanding, and appropriate land use. Soils however, are non-discrete complex natural entities which are dynamic over time and space. Local soil classifications are place-based, culturally-aligned, pragmatic and holistic; while scientific taxonomies tend to be universalising, theoretically focused, and technical (Niemeijer & Mazzucato, 2003; Ngailo & Nortcliff, 2007; van Huyssteen, 2013).

In comparison to western classification systems (e.g. WRB, USDA, SA Taxonomy), LSK classifications are thus a much more accessible means of communicating about local soils between locals and soil scientists (Nethononda & Odhiambo, 2011). In Africa, where costly local-scale scientific soil surveys often do not exist or their scientific jargon is a barrier, LSK offers readily accessible and meaningful soil knowledge. Historically, soil conservation projects often imposed expert knowledge on beneficiaries, and new methods were introduced without considering farmers' needs or practices. Farmer resistance to these technologies was attributed to ignorance, which it was thought, could simply be overcome through increased extension efforts. Nevertheless, it has since been shown that the mobilisation of LSK in development projects is decidedly more successful and sustainable than top-down technocratic interventions. Researchers in the field thus argue that knowledge co-production is therefore paramount (den Biggelaar, 1991; Norton *et al.*, 1998; Niemeijer & Mazzucato, 2003; Ryder, 2003; Oudwater & Martin, 2003; Ogen, 2006; Kipsat, 2007; Martínez-Villegas, 2007; Obalum *et al.*, 2012; Bargout & Raizada, 2013; Peña-Venegas, 2016; de Bruyn *et al.*, 2017; Buthelezi-

Dube *et al.*, 2019; Bapfakurera & Nduwamungu, 2020; Huynh, 2020; Manyevere *et al.*, 2020; Ekobi *et al.*, 2023). In this regard and based on South African case studies, Buthelezi-Dube (2018:84; 2019:8, respectively) concluded that:

[i]rrespective of the level of correlation between scientific and local maps, farmers' local classifications contained [more] detailed pedological information [than the official South African system] that can contribute to the development of classifications systems that are both user-friendly and relevant for local needs.

Farmer perceptions and assessment considered other [complex] biophysical properties rather than [only] measured chemical fertility – suggesting fundamental differences in approach. [...] For example, farmers' evaluation of red soils was not based on their chemical fertility (poor, due to intense weathering) but rather on soil water dynamics (under prevailing local climate changes), a factor not often included in a routine scientific evaluation. Such additional information could complement the laboratory data.

WSS can thus be taught much by LSK, and together produce sustainable synergies. In 2002, Barrera-Bassols and Zinck reviewed 432 ethnopedological studies across the world and conclude that extant LSK are positively correlated with both increased linguistic and biological diversity and conservation, often in fragile marginal environments. Reij (1991), Critchley *et al.* (1994), and Mwangi (1998) provide reviews of LSK practices specifically across African countries. There are further assorted examples of LSK practices documented in the academic literature, ranging across: Burkina Faso (Ouedraogo & Kaboré, 1996; Gray & Morant, 2003), Bolivia (Halloy *et al.*, 2005), Cameroon (Büttner & Hauser, 2003), Ethiopia (Krüger *et al.*, 1996, Tegene, 1998; Dea & Scoones, 2003; Erkossa & Ayele, 2003; Amede & Taboge, 2007; Mulat, 2013; Megersa, 2018; Maru *et al.*, 2019; Birhanu *et al.*, 2021), Ghana (Asiamah *et al.*, 1997; Antwi *et al.*, 2006; Anyan, 2017; Omari *et al.*, 2018), Guinea (Fairhead & Scoones, 2005), Haiti (White & Jickling, 1995; Bargout Raizada, 2013), Honduras (Hellin *et al.*, 1999), India (Scott & Walter, 1993), Kenya (Wakindiki *et al.*, 2007), Liberia (Frausin *et al.*, 2014), Mali (Kassogue *et al.*, 1996; Crane, 2002), Malawi (Moyo & Moyo, 2013), Mexico (Pulidoa & Bocco, 2003), New Zealand (Roskrige, 2010), Niger (Fatondji *et al.*, 2007), Nigeria (Kolawole, 2004; Ogen, 2006; Ihenacho *et al.*, 2019), Peru (Halloy *et al.*, 2005), Philippines (Concepcion & Batjes, 1997), Rwanda (Bapfakurera & Nduwamungu, 2020), Sardinia (Capra *et al.*, 2015), Senegal (Carney, 1991), Sierra Leone (Frausin *et al.*, 2014), Tanzania (Shemdoe, 2017; Mtakwa *et al.*, 2019); Uganda (Akullo *et al.*, 2007), Zimbabwe (Nyamapfene, 1983; Chibudu *et al.*, 2001; Mabeza, 2014), and South Africa (Critchley & Netshikvhela, 1998; Magoro & Masoga, 2005; Materechera, 2008; Denison & Wotshela, 2009; Nethononda &

Odhiambo, 2011; Buthelezi *et al.*, 2013; Rankoana, 2017; Buthelezi-Dube *et al.*, 2018; Buthelezi-Dube *et al.*, 2019; Manyevere *et al.*, 2020; Ekobi *et al.*, 2023). Yet, Pérez-Rodríguez *et al.* (2023:1) observe that, “[such] ethnoscience remains marginalised in university curricula, the production of scientific papers, and decision-making.” Therefore the above literature is a useful resource to be able to begin integrating LSK into tertiary soil science curricula.

There remains, however, a paucity of ethnopedological studies in South Africa (Buthelezi-Dube *et al.*, 2018). Accessible South African peer-reviewed literature on indigenous soil knowledge, beliefs and practices was analysed against the aforementioned ethnopedological K–C–P schema (Barrera-Bassols & Zinck, 2003) (See Appendix 4.5). It was found that sites studied in the eleven articles were conducted in the predominantly rural provinces of Limpopo (4), KwaZulu-Natal (4), Eastern Cape (4), and North West (2). Moreover, it was found that all eleven studies included a focus on LSK’s knowledge aspect (Corpus), while nine included soil management practices (Praxis), and only four listed any beliefs (Kosmos). Moreover, numerous of the studies sought to directly compare LSK against scientific standards. This is similar to the findings of WinklerPrins and Barrera-Bassol (2004). Ethnopedology is thus not a well-studied topic in South Africa, nor are studies holistically focused.

In contrast, an example of a particularly well-studied LSK is that of African Dark Earths (AfDE) and their South American analogue, Amazonian Dark Earths (ADE). These *Terra Preta* (dark earths) are carbon-rich high-fertility human-made soils (anthrosols³⁵). In Africa (in forest and forest-savanna transition zones) forms of these soil amendment practices continue today. While in Amazonia, these soils are the archaeological legacy of pre-Columbian farming settlements, where these fertile middens remain sought after by modern farmers. These fertile soils challenged long-held beliefs that highly weathered nutrient-poor tropical soils could not sustain intensive agriculture (Fairhead & Leach, 2009; Frausin *et al.*, 2014). The formation of these dark earths is a complex process involving several factors. Firstly, indigenous farm steading practices, such as the incorporation of pottery shards and biochar from slow-burning fires, significantly contribute to soil enrichment. Secondly, these practices influence soil fauna, particularly favouring earthworms and ants, which enhance soil structure and nutrient cycling.

³⁵ Although some academic debate remains – see for example: Silva *et al.* (2021) versus, Lombardo *et al.* (2022) – *Terra Preta* are widely considered anthrosols i.e. soils of anthropogenic origin.

Thirdly, the combination of nutrient deposition, charring, and biological activity leads to increased nutrient levels, reduced acidity, and a positive feedback loop, resulting in the formation of these fertile black anthrosols. In the last decade, there has been an increase in the scientific adoption of biochar amendments for soils. Benefits include: increased soil organic matter (SOM), increased fertility through nutrient adsorption, increases in microbial activity, soils structure and aggregation improvements, enhanced water infiltration and retention, long-term stability, and importantly for climate change mitigation: carbon sequestration. Moreover, the high fertility of these soils has persisted over hundreds of years in extremely leached environments, making for increased research interest for sustainable agricultural applications. (Glaser & Woods, 2004; Erickson, 2004; Lehmann *et al.*, 2004; Lawa & Oyuela-Caycedo, 2008; de Ruivo *et al.*, 2009; Woods *et al.*, 2009; WinklerPrins & Aldrich, 2010; Glaser & Birk, 2012; Schmidt, 2013; Solomon *et al.*, 2016; Howard, 2017; WinklerPrins & Levis, 2021; Asare, 2022). Studies have also found anthropogenic dark earth analogues (similarly hundreds of years old) in Australia and Germany (Downie *et al.*, 2011; Wiedner *et al.*, 2015). The recent increase in biochar research stems directly from these ethnopedological understandings of AfDE and ADE (Soentgen *et al.*, 2017; Hilbert & Soentgen, 2021; Arregui, 2022). Thus, LSK have proven significant in expanding understandings and sustainable use of soils.

Hilbert and Soentgen (2021:8), however warn of IKs like *Terra Preta* being co-opted and commodified by western science and attendant commercialism:

it is important to take note that the climate-saving [...] *Terra Preta Nova* is not simply a “special soil type” that has formed over hundreds of years, but rather a substance, a stuff, that can be deliberately produced through a very specific technical process. [...] By highlighting only certain characteristics of the *Terra Preta* properties, (those strictly relatable to climate change) and reframing the soil as a universally applicable and easily “manufacturable” substance, *Terra Preta Nova* is less an archeologically localized soil and more a commodity.

To avoid unethical epistemic extractivism, holders of LSK need to be respected and included as equal co-researchers in a participatory approach (Ryder, 2003; Grosfoguel, 2015; Hilbert & Soentgen, 2021). To this end Tuhiwai Smith (2014) encourages researchers to reflect on the positionality, dynamics, initial meeting, process, timeframes, expectations, similarities and differences that may exist between an indigenous community (the researched) and the researcher (the invited). Ethnopedology thus necessitates a social sensitivity, humility, openness and respect, which ‘objective’ approaches in WSS may otherwise lack (WinklerPrins & Barrera-Bassol, 2004). Notably, participatory research carried out in this manner has the

local community, its needs and values, at its centre – and the results of the research primarily benefit the community (Keane *et al.*, 2017). In acknowledging both the value and vulnerability of the traditional knowledge of communities (Mathur, 2003), the UN's WIPO (World Intellectual Property Organization) recently adopted the *Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge*, which affords certain protective measures (WIPO, 2024). Acuña *et al.* (2015:122) conclude that: “is important to care for the Earth, not only because of utilitarian, productive or economic interests, but because it is part of our moral community [...] land in particular are new moral objects upon whose ethics it is important to reflect.” Modern soil science is thus challenged to engage with LSK and expand its epistemic with new reflections and by integrating understandings such as these.

In this respect, Critchley and Netshikovhela (1998) argue that LSK, and the study thereof, offers valuable insights into local practices, but merely researching it without implementing solutions is insufficient. Others argue that modernization and globalization threaten the survival of many cultures, including their traditional ecological knowledge; consequently studying and documenting LSK is crucial for preserving cultural heritage and indigenous rights (Sandor *et al.*, 2006:43). Additionally, Buthelezi-Dube *et al.* (2018) list numerous studies where LSK and scientific soil classifications are well correlated, and juxtaposes numerous others where this is not the case. Despite such debates, it is widely acknowledged that by meaningfully bridging the gap between local and scientific knowledge, researchers can develop more effective, sustainable, and culturally appropriate soil fertility and land degradation measures. Nevertheless, this integration faces challenges such as cross-cultural communication, representation and participation hurdles, intellectual property rights, underlying political and power dynamics, and the potential for idealising either western or indigenous practices. Bargout and Raizada (2013:5) level the critique that “very few foreign-led interventions have adopted, improved upon, or scaled up these grassroots practices, and in many cases do not have any knowledge of them, suggesting a lack of true partnership with local farmers.” To overcome these challenges, soil scientists needs must engage with social science participatory research methods, which recognize the value of LSK across all K–C–P domains. The goal is to seek a meaningful synergy between soil science and LSK, which transcends dichotomy, and co-produces knowledge. Such an empowering approach can ultimately generate local solutions to the best advantage of the community (Nyerere, 1968; den Biggelaar, 1991; Agrawal, 1995; Hagmann *et al.*, 1996; Sillitoe, 1998b; Kauffman, 1999; Van Averbek, 2002; Ryder, 2003;

Gowing *et al.*, 2004; Ogen, 2006; Buthelezi-Dube *et al.*, 2018; Bapfakurera & Nduwamungu, 2020; Manyevere *et al.*, 2020). Bearing this in mind, and to highlight complementary strengths, Table 4.1 accordingly contrasts the epistemic differences and commonalities between IKS and western science.

Table 4.1: Comparison of similarities, differences and shared tenets and values between indigenous knowledge and western science (after Stephens, 2000; Aikenhead & Ogawa 2007).

Themes	Indigenous Knowledge	Common Ground	Western Science
Organizing Principles	• Holistic • Includes physical & metaphysical world linked to moral code • Emphasis on practical application of skills and knowledge	• Universe is unified • Body of knowledge stable but subject to modification	• Part to whole • Limited to evidence and explanation within physical world • Emphasis on understanding how
Habits of Mind	• Trust for inherited wisdom • Respect for all things	• Honesty • Inquisitiveness • Perseverance • Open-mindedness	• Scepticism
Skills and Procedures	• Practical experimentation • Qualitative oral record • Local verification • Communication of metaphor and story connected to life, values, and proper behaviour	• Empirical observations in natural settings • Pattern recognition • Verification through repetition • Inference and prediction	• Tools expand the scale of direct and indirect observation and measurement • Hypothesis falsification • Quantitative written record • Global verification • Communication of procedures and theory
Knowledge	• Integrated and applied to daily living and traditional subsistence practices	• Plant and animal behaviour, cycles, habitat needs, interdependence • Properties of objects and materials • Position and motion of objects • Cycles and changes in earth and sky	• Discipline-based • Micro and macro theory (e.g., cell biology and physiology, atomic theory, plate tectonics, etc.) • Mathematical models

In engaging with LSK there are thus valuable avenues (previously blind-spots) to expand soil science's epistemic and undermine its biases – leading to meaningful innovations for modern problems in (always) local contexts (Vaughn, 2019; Ludwig *et al.*, 2021). Be that as it may, truly meaningful engagement requires expanding one's worldview to allow for the existence

of the epistemics of others. In support of such advances, Winiwarter & Blum, (2006:119) assert that, “looking at worldviews should also be a reflexive exercise. Like all human beings, soil scientists cannot live without forming some views about life and the world. Their work is influenced by their world-view, too.” It is thus valuable to the discipline and sustainability goals, for soil scientists to reflexively interrogate their own worldview and question the epistemic assumptions of the discipline. Such personal and disciplinary development can be promoted by the *process* of interdisciplinary and community engagement required by ethnopedological approaches and engagement with LSK. Crucially, the problematized western ideas are perpetuated through the western university in Africa: “mainstream ideas about soil management, particularly soil survey, soil erosion control and land use planning were reinforced in colleges established in many countries in east and southern Africa” (Dea & Scoones, 2003:466). Therefore, for synergistic cooperation to become embedded in the discipline’s epistemic, engaging with multiple epistemologies shall need to be fostered in the training of soil scientists. In recognition of this this Friedrichsen *et al.* (2022:1) call for, “multi-disciplinary soil science training, a normative change in the identity of a soil scientist, and diverse methodologies.” Transformation of the tertiary soil science curriculum is thus a key site to advance the obligation to expand the discipline beyond current biases and epistemic bounds.

4.6 Conclusion

This chapter sought to explore the interplay between WSS and LSK systems. It delved into the foundations, development, and underlying assumptions of WSS. The discussion then critically analysed potential biases inherent in WSS. Alternative perspectives on soil knowledge, drawing from indigenous and local traditions, were then introduced.

This discussion is not a recrimination of WSS being – something as simplistic as – ‘being wrong’. Rather this chapter puts forward arguments and evidence highlighting that as a discipline, it has held a singular viewpoint and dominates the knowledge discourse to the exclusion of other epistemologies. This critique seeks to challenge these narrow biases in an endeavour to extend the scope and capacity of soil science.

Accordingly, the chapter concluded that including LSK in South African university soil science curricula can broaden the discipline's traditional epistemic, undermine its current biases, and result in meaningful transformation. Additionally, the academic literature has seemingly not made an explicit connection between the epistemic alienation of indigenous communities (resulting in failed WSS interventions), and the epistemic alienation experienced by African students (resulting in poor performance) in western universities. Considering that trained soil scientists leave the university to practice in the field, an Africanising transformation of the discipline in the university is requisite to begin addressing disjunctures within the university, and beyond it. *How* such an Africanising transformation might be advanced remains unclear. Hence experienced experts in the fields of curriculum transformation and Africanisation, soil science, and IK studies were interviewed in this regard. The study's methodology is accordingly described in the next chapter.

CHAPTER 5: RESEARCH DESIGN, METHODOLOGY AND METHODS

5.1 Introduction

There is much theory and discussion around Africanisation and curriculum transformation. Yet, how to productively engage in the process of Africanising an undergraduate soil science curriculum remains unclear. Thus, this study thus posited the research need to identify guiding principles and produce a process theory which could be used to Africanise a soil science curriculum. In order to arrive at these goals, the research paradigm, design and methods described in this chapter were utilized.

5.2 Research Paradigms and Designs: An Overview

The term ‘research paradigm’ was coined by Kuhn (1970). A researcher’s choice of research paradigm dictates “what should be studied, how it should be studied, and how the results of the study should be interpreted” (Okesina, 2020:58). Thus, the research paradigm validates methodological choices (O’Donoghue, 2007; Blaikie, 2009). A researcher’s worldview more specifically is “a set of shared beliefs, that informs the meaning or interpretation of research data” (Kivunja & Kuyini, 2017:26). Importantly, the worldview of the researcher impacts on how they decide to undertake research. This makes it important to state one’s worldview or research paradigm upfront (Winston, 2012; Makombe, 2017). However, worldviews are implicit; thus, a research paradigm makes a researcher’s worldview, explicit. This communicates (to the reader) the conceptual lens through which the research is conducted – thus, communicating beliefs and even possible biases in the author’s selection of research approach, and even interpretation of findings (Mills *et al.*, 2006; Evelyn *et al.*, 2008).

A research paradigm comprises the following facets: ontology, epistemology, axiology, theoretical perspective, methodology, methods, and data sources (Morgan, 2007; Ruto-Korir & Lubbe, 2010; Rehman & Alharthi, 2016; Denzin & Lincoln, 2017). This research paradigm is founded in the researcher’s ontological and epistemological beliefs and their axiology (ethical values), to which their theoretical perspective is aligned. In turn this informs their choice of methodology, methods, and data sources. Importantly, the design of the research is robust when these factors are congruent with each other (O’Donoghue, 2007; Moon &

Blackman, 2014; Makombe, 2017; Ugwu, 2021). Figure 5.1 illustrates the aligned and dependent nature of these concepts in research design.

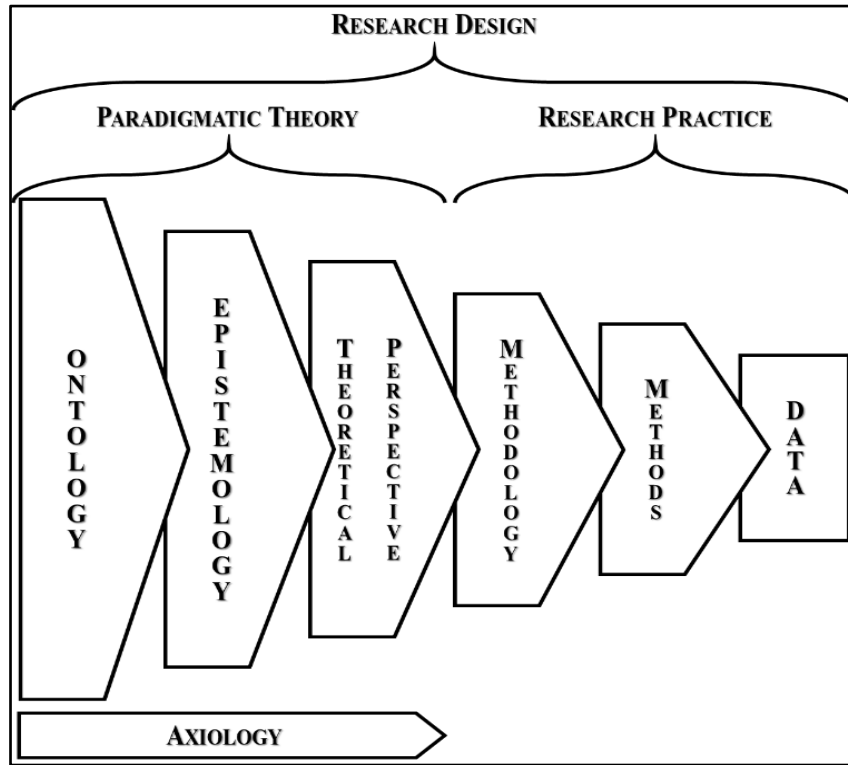


Figure 5.1: The alignment of the components of a research design (following Crotty, 1998; Hay, 2002; Morgan, 2007; Moon & Blackman, 2014; Blaikie & Priest, 2017; Makombe, 2017).

A clear definition of each of these concepts is required so that a researcher may effectively design their research in order to appropriately answer their research problem (Poni, 2014). Ontology is the study of the nature and understanding of *being*. In other words, ontology is concerned with the (many different) beliefs as to what constitutes reality and existence therein. Examples of ontology range between realism and relativism; wherein the former, a single independent reality exists, while in the latter, the existence of multiple realities is accepted. Epistemology on the other hand is the study of the nature of *knowledge* and *knowing*. Examples of differing epistemologies include: objectivism, constructionism, and subjectivism (Crotty, 1998; Moon & Blackman, 2014; Cooksey & McDonald, 2019; Grix, 2019). The concepts of ontology and epistemology are inexorably linked (Blaikie & Priest, 2017), as was famously put forth by Descartes: “cogito, ergo sum” (I think, therefore I am) (Moriarty, 2008:xii).

The axiological position, which considers the value-judgements (ethical positioning) embedded in the research, is considered in tandem with the ontology and epistemology (Morgan, 2007; Given, 2008; Kivunja & Kuyini, 2017). The researcher's theoretical perspective is then their unified philosophical orientation and system of values toward research – that is to say “the relationship of thinking to being” (Moon & Blackman, 2014:7). Well-known examples of this theoretical perspective are positivism, constructivism, postmodernism, and pragmatism (Mackenzie & Knipe, 2006; Taylor & Medina, 2011). By delineating their ontology, epistemology, axiology and theoretical perspective, the researcher can proceed with now explicit philosophical and value-based assumptions – which operate within well-founded traditions and logics of inquiry. Subsequently, the researcher can then identify and select a congruent methodology, methods, and data to suitably interrogate the research problem (Kivunja & Kuyini, 2017). Hay (2002:63) summarises the relationship between ontology, epistemology, and methodology as: “[the] relationship is directional in the sense that ontology logically precedes epistemology which logically precedes methodology” (refer to Figure 5.1).

A research methodology is an analytical strategy (linking the particular choice and use of methods to the intended research outcome); while methods are the tools operationalised to gather appropriate data (Crotty, 1998; Hay, 2002; Okesina, 2020). The methodology makes the methodological assumptions and the limitations of the data collection and analysis instruments explicit – thereby aiding to address shortcomings and increase reliability (Okesina, 2020). Methods are the way in which data are technically and practically gathered (Berg, 2001; Bloor & Wood, 2006; Gray *et al.*, 2007; Edmonds & Kennedy, 2017). Thus, the methods (tools) chosen should be consistent with stated methodology (procedure) (Bogdan & Biklen, 2007).

This study adopts the general research design framework followed by authors such as Crotty (1998), Blaikie and Priest (2017), Makombe (2017), and Okesina (2020). This school of thought explicitly rejects the elevating of qualitative, quantitative, and mixed-methods to the level of research paradigm. They argue that only at the methodological level are qualitative, quantitative and mixed-methods approaches differentiated. This avoids collapsing the research paradigm into a simplistic choice of methodology, and makes fundamental paradigmatic choices explicit (see Appendix 5.1). This is deemed important, as the recognition and valuing of multiple worldviews is consequential to this research.

This chapter now proceeds to detailing the specific research design choices made in undertaking this research project.

5.3 Research Design of This Study

A researcher's fundamental choice of research paradigm is incontestable, for, as Lincoln and Guba (2013:59) put it "ultimately the proponent of any paradigm is forced to the admission that he or she believes what is believed because he or she believes it, however self-referential that may be". Chilton and Leavy (2014) similarly assert that the choice of a paradigmatic approach in addressing a research problem is *a priori* legitimized by the researcher's philosophical belief in the value of that approach. Nevertheless, the successful execution of the research – within the logics (the set of first principles, beliefs, or assumptions) of the chosen paradigm – may well be critiqued.

Importantly, when a researcher delineates their research paradigm or worldview, they (1) become mindful of their philosophical departure point (and its limitations) and (2) communicate to the reader their conceptual lens (Evelly *et al.*, 2008; Creswell & Poth, 2018; Nguyen, 2019; Okesina, 2020). What follows is my explicit demarcation of my worldview and how this shaped my approach to the research problem. This is achieved by sharing a short narrative account of what drew me towards this research project. This account shall be framed against Okesina's (2020:58) questions, namely: (1) what should be studied? (2) how it should be studied? and (3) how should the results of the study be interpreted?

In 2014, while completing my Master's degree in Geography, I undertook some undergraduate lecturing. Having departed (disillusioned) from professional consulting in the environmental management sector, I discovered I enjoyed the engagement and challenges of tertiary teaching. Importantly, I came to feel that lecturing added long-term, positive value in the training of critical thinking. I realised a wish to nurture this skill in others. I began reading, teaching and learning theory, attending teaching and learning seminars, and engaging in curriculum design discussions. I encountered formal pedagogic concepts such as constructive alignment (Biggs, 1996), scaffolding (Wood *et al.*, 1976; Morrow, 2007), cognitive development (Piaget, 1964), hidden curriculum (Cornbleth, 1984; Portelli, 1993), zone of proximal development (Vygotsky,

1978), deep learning (Biggs & Tang, 2007), and community of practice (Lave & Wenger, 1991; Grant, 2005).

My immersion in tertiary teaching was within the South African context of massification (Cloete, 2014; CHE, 2016; Ramathan, 2016), underpreparedness (Jacobs, 2007; Chokwe, 2013; Pineteh, 2014; McKay, 2016), student protests (Langa, 2016; Le Grange, 2016; Luescher & Klemenčič, 2016; Costandius, 2018), and state policy reform driving tertiary sector transformation (Cloete, 2006; Ensor, 2006; Odhav, 2009; Lange, 2020; Rensburg, 2020), while university throughput rates remain low (Chetty & Pather, 2015; Manik, 2015; Moodley & Singh, 2015; Singh, 2015; CHE, 2017; The Presidency, 2017; Mutakwa & Mhakure, 2019).

As I encountered these teaching and learning challenges, I contemplated the possible root causes of these issues, and encountered well-founded arguments for the decolonisation and Africanisation of curricula. Chief amongst these is the epistemic and ontological alienation of African students from traditional euro-centric tertiary curricula (Freire, 1970; Honikman, 1982; Fanon, 1986; Loo & Rolison, 1986; Leon & Lea, 1988; Badenhorst *et al.*, 1990; Cobern & Aikenhead, 1997; Kagee *et al.*, 1997; Matos, 2000; Stein *et al.*, 2001; van Wyk, 2002; Sennette *et al.*, 2003; McKenna, 2004; Nakusera, 2004; Dei, 2007; Shizha, 2010; Nyamnjoh, 2012; Babaci-Wilhite & Geo-Jaja, 2014; Msila, 2014; Chetty & Pather, 2015; Mutekwe, 2015; Lebowitz, 2016; Mheta *et al.*, 2018; Janks, 2019; Milaras & McKay, 2019; Seehawer & Breidlid, 2021). However, there was (and is) no ‘*how to*’ roadmap to meaningfully engage in Africanising a curriculum. Rather the literature identifies students’ needs for a relatable (Africanised) curriculum and tends to philosophise about this need. It was these perspectives, and the lack of advice as to how to engage in Africanising a curriculum, which gave rise to my undertaking this study.

Thus it can be seen that my learning has been self-directed and reflexive (see Milaras & McKay, 2018). Having reflected on my own teaching, and having facilitated the learning of hundreds of students (both in large groups and individually) in innumerable modules, tutorials, and practicals – I have come to view learning as socially constructed. Accordingly, my epistemological position is best aligned with constructionism. Moreover, my lived experiences

have convinced me to accept that others can hold equally valid truths for themselves – which are either partly or entirely, counter to my own. For me, this has demonstrated the existence of differing, yet overlapping and co-created realities. My lived ontology is thus that of relativism, I regard knowledge as value-laden, and consequently hold a theoretical perspective of social constructivism (see Appendix 5.1). Kaushik and Walsh (2019:2) validate this approach when they state that “constructivist research is shaped from the bottom up, i.e., from individual perspectives to broad patterns, and ultimately to broad understandings.” This is congruent with, and evidenced in, the manner in my research approach and execution.

It is meaningful (for the purposes of maintaining internal research congruency and alerting the reader) to not just to name, but also to explicitly define the perspectives upon which research rests (Makombe, 2017; Okesina, 2020). Relativism is the ontological belief in the existence of multiple realities, as engendered by multiple lived subjectivities (Bloor & Wood, 2006; Ugwu, 2021). Constructionism as an epistemology, is the philosophical theory that there is no objective truth separate from the observer; but rather that knowledge is generated or ‘constructed’ within an individual subject as a direct consequence of their own unique lived experiences. The generation of *valid* knowledges is viewed as multifarious, due to this construction of knowledge being formed by the interaction of diverse subjects with a diverse world (Crotty, 1998; Denzin & Lincoln, 2017). Constructionism is accordingly rooted in the ontology of relativism (Adom *et al.*, 2016). The consequent theoretical perspective of constructivism stems from Piaget’s theories which posit that individual cognitive development occurs in a social milieu (Mutekwe, 2013; Amineh & Asl, 2015). A further detailed definition is provided by Lincoln and Guba (2013:40):

Given that the ontological presupposition of relativism has been accepted, it follows that the relationship between the knower and the knowable (to-be-known) is highly person- and context-specific. [...] [Reality is] highly subjective, mediated by the knower’s prior experience and knowledge, by political and social status, by gender, by race, class, sexual orientation, nationality, by personal and cultural values, and by the knower’s interpretation (construction) of the contextual surround. Knowledge is not “discovered” but rather created; it exists only in the time/space framework in which it is generated.

Thus, it becomes apparent that the axiology of such a fundamentally relativist approach sees knowledge as value-laden, rather than objective and value-free. In this case, the researcher’s subjectivities, empathies, and participation are viewed as a meaningful part of the research

(Creswell & Poth, 2018; Barnes, 2019; Kaushik & Walsh, 2019). Such a perspective is concordant with the grounded theory which this research produced.

To return to and answer Okesina's (2020:58) three guiding questions – and as evidenced from the narrative of my research journey – I deem it: (1) valuable to undertake a study which investigates how to better develop and facilitate locale-specific student learning; and that (2) this is best done inductively by qualitatively inquiring into the diverse professional experiences of expert lecturers (with a focus on how curriculum transformation can foreground diverse ways of knowing); and that (3) the results be interpreted through a relativistic frame in which plural epistemologies are deemed valid. Creswell and Poth (2018:88) support this by stating: “researchers recognize that their own background shapes their interpretation, and they ‘position themselves’ in the research to acknowledge how their interpretation flows from their own personal, cultural, and historical experiences.” This being the case, grounded theory presented itself as a very compatible methodological strategy (and method) for tackling my research problem of interest (Mills *et al.*, 2006; Chong & Yeo, 2015).

5.4 Methodology and Methods

This section motivates the methodological selection of CGT and discuss it as both methodology and method. Accordingly, it proceeds to outline the literature and theory comprising this overarching CGT research approach, and then details the analysis undertaken.

The epistemological choice of Charmaz's CGT was motivated in particular by its explicit and systematic approach to theory generation, in the notable absence of a pre-existing theoretical framework for Africanising a soil science curriculum. In comparison to other inductive qualitative methodologies, CGT is distinguished by its primary goal not being description, interpretation, or the detailing of a narrative or case, but rather the rigorous development of a new, substantive theory (Willig, 2013; Merriam & Tisdell, 2016; Bakker, 2018). For example, methodologies such as phenomenology or narrative inquiry focus on describing lived experience or interpreting stories (Crotty, 1998). On the other hand, while thematic analysis can identify patterns, it lacks the rigorous methods of CGT for developing a cohesive, integrated theoretical explanation. Similarly, the primary aim of ethnography is a rich cultural

description, and case study research focuses on a specific unit of analysis (Ngulube, 2015; Saldaña, 2016). CGT however is distinguished from these comparable qualitative methodologies specifically by its systematic and iterative process of constant comparative analysis and theoretical sampling. This move from data to relational concepts, goes beyond rich description and thematic summary and advances theoretical abstraction, thus building an explanatory model or theory (Charmaz, 2006).

While CGT is not historically an African or specifically a decolonial framework, its core principles are well-aligned with the goals of ‘critical’ research. The choice to use CGT in this context is motivated by its primary aim of novel theory generation, along with CGT’s included considerations of reflexivity, social justice, power dynamics, and the co-construction of knowledge (Denzin & Lincoln, 2017). For example, Charmaz’s CGT approach highlights that the researcher is not a neutral, detached observer. Researchers using CGT are expected to be aware of their own positionality (their social experiences, biases, and theoretical commitments) and how these factors shape the research process and findings (Charmaz, 2006) (see Section 5.3). Similarly, this critical self-awareness is a cornerstone of decolonial and critical race theory, which argue that all knowledge is situated, while ‘objective’ research approaches can reinforce dominant power structures (Keane *et al.*, 2017; Khosi and Vráblíková, 2020; Benvenuti *et al.*, 2022). Nevertheless, critical and decolonial methodologies can often focus on social action, political liberation (Mheta *et al.*, 2018; Seehawer & Breidlid, 2021); whereas this research is designed to generate new theory to address the research gap (see Section 1.3). Thus, here, CGT is argued to be well-suited to Africanising transformation research (and similarly resonates with the decolonial project and *ubuntu* philosophy), as the principles of CGT include critical reflexivity, co-generation of knowledge, and social justice intentions in its critique of positivism (Bainbridge *et al.*; 2019).

5.4.1 Constructivist Grounded Theory Methodology

Grounded theory is an inductive, process-based (emergent), qualitative research methodology. It allows for rich qualitative data to be collected and analysed in a systematic manner (of constant comparison) which aims to ‘surface’ or reveal theory which is ‘grounded’ in the data – hence its name (Dick, 2005; Charmaz, 2006; Creswell, 2012; Chong & Yeo, 2015; Tie *et al.*, 2019). Willig (2013:213) succinctly defines grounded theory as “the progressive identification and integration of *categories of meaning* from data.” Moreover, it is very important to note that grounded theory is both method and theory (Wertz *et al.*, 2011). That is to say that firstly,

grounded theory provides guidelines on the *methods* with which to analyse data (identifying, comparing, linking and relating meaningful categories emergent from the data). While secondly, grounded theory generates *theory* as an end-product i.e., an explanatory theoretical framework with which to comprehend the phenomenon being researched (Willig, 2013; Bryant, 2017).

The seminal text of grounded theory was the 1967 monograph: *The discovery of grounded theory: Strategies for qualitative research*, by sociologists Glaser and Strauss (Charmaz, 2006). Importantly, Glaser and Strauss (1967) challenged the then-dominant positivist and quantitative research approaches in the social sciences. The positivist approaches to social science research in the mid-20th century focused on validating pre-conceived hypotheses against existing theories, by reducing human experience to quantitatively measurable variables. This approach viewed the researcher as an objective observer who recorded sociological facts and did not ‘participate in’ the research inquiry or influence it with their values. Positivists of the time viewed qualitative approaches as biased, unsystematic, ad-hoc, and anecdotal. Nevertheless, the serious shortcomings of the quantitative approach included, *inter alia*: unacknowledged researcher bias and precedence, ignoring ‘human’ research problems which did not fit the positivist paradigm of inquiry, rejecting multiple ways of knowing, and a lack of new theory generation. The birth of grounded theory was a direct response to these shortcomings. Grounded theory as qualitative research is expressly systematic, acknowledges researcher involvement, gives ‘voice’ to participants, and generates new theory from the data itself (Taylor & Bogdan, 1998; Charmaz, 2006; Willig, 2013; Creswell, 2015; Merriam & Tisdell, 2016; Bryant, 2017; Bakker, 2018).

Charmaz, (2006:5) distils the defining characteristics of Glaser and Strauss’ grounded theory as follows:

- Simultaneous involvement in data collection and analysis;
- Constructing analytic codes and categories from data, not from preconceived logically deduced hypotheses;
- Using the constant comparative method, which involves making comparisons during each stage of the analysis;
- Advancing theory development during each step of data collection and analysis;
- Memo-writing to elaborate categories, specify their properties, define relationships between categories, and identify gaps;
- Sampling aimed toward theory construction, not for population representativeness;

- Conducting the literature review after developing an independent analysis.

Nonetheless, over time, as in all maturing traditions, paradigmatic schisms occurred within the field – incidentally between grounded theory’s founders: Glaser and Strauss. It does not however substantively support this research to explicate the nuances³⁶ of this particular debate here. In short, the Glaser-style of grounded theory is an intuitive and emergent approach; whereas Strauss and Corbin’s approach is more positivist leaning and deterministic (Dick, 2005; Atkinson *et al.*, 2003; O’Donoghue, 2007; Creswell, 2012). Further critique (Bryant, 2014) in the 2000s resulted in the development of more postmodern approaches to grounded theory. Chief amongst these second-generation grounded theory theorists is Charmaz’s constructivist approach (Charmaz, 2006; Wertz *et al.*, 2011; Birks & Mills, 2015; Bryant, 2019). Tie *et al.* (2019) classify these three distinct approaches to conducting grounded theory as ‘traditional’ (following Glaser), ‘evolved’ (following Strauss and Corbin), and ‘constructivist’ (following Charmaz). Creswell (2012) similarly defines these three traditions, respectively naming them: systematic design, emerging design, and constructivist design.

Tie *et al.* (2019:2) go on to differentiate Charmaz-style CGT practice as: “focus[ing] on how participants *construct meaning* in relation to the area of inquiry. [Moreover,] a constructivist [grounded theory researcher] *co-constructs* experience and meanings with participants.”³⁷ Mills *et al.* (2006), Willig (2013) and Bryant (2014) similarly assert that a constructivist grounded theorist is explicitly and subjectively involved in *constructing* categories and theories from the data, rather than somehow objectively *discovering* them in the data (as in traditional grounded theory). Congruent with my constructivist theoretical perspective, the Charmaz-style approach has been selected as most appropriate for this research.

Charmaz expressly distinguishes this ‘variant’ of grounded theory (2005:509) and (1990:1169):

Constructivist Grounded Theory [...] does not subscribe to the objectivist, positivist assumptions in its earlier formulations. A constructivist approach emphasises the studies phenomenon [and] take a reflexive stance on modes of knowing and representing studied life. [...] It does not assume that [...] impartial

³⁶ For details on the principle paradigmatic schism see: Strauss & Corbin (1990), versus Glaser (1992).

³⁷ Italic emphases added.

observers enter the research scene without an interpretive frame of reference. Instead, what observers see and hear depends upon their prior interpretive frames, biographies, and interests as well as the research context, their relationships with research participants, concrete field experiences, and modes of generating and recording empirical materials. No qualitative method rests on pure induction – the questions we ask of the empirical world frame what we know of it. In short, we share in constructing what we define as data. Similarly, our conceptual categories arise through our interpretations *of* data rather than emanating *from* them or from our methodological practices. [...] The researcher creates an explication, organisation and presentation *of* the data rather than discovering order *within* the data. The discovery process consists of discovering the ideas the *researcher* has about the data after interacting with it.

CGT is also distinguished by abductive inquiry (Lincoln & Guba, 2013). Bauer (2014: 11) defines abduction as “a process of hypothesis building from insights and clues of structural patterns.” Thus, CGT moves beyond generalising from the specific and seeks to (by means of intuitive/abductive insights) produce novel theoretical understandings (grounded in the data) (Bryant, 2017; Bryant, 2019).

CGT is thus well-suited to inductively and abductively interrogate, unearth and theorise the qualitative complexities and commonalities of the multiple subjective perspectives regarding a contested and ‘ill-defined’ imperative – such as the process of Africanising a soil science curriculum. Additionally, there is little formal theory in this field. Thus, a hypothesis-testing approach to the research problem would be inappropriate; whereas, CGT is an emergent research process, and aims to produce theory which is grounded in the data (Wertz *et al.*, 2011). Grounded theory also requires a researcher to critically reflect on their positionality within the research (O’Toole, 2010). Moreover, and as aligned with the preceding researcher vignette, “[Grounded theorists] can enact an explicit value stance and agenda for change.” (Denzin & Lincoln, 2017: 561). Ergo, CGT is both an appropriate *methodology* to tackle the research problem at hand and is also suited to the type of researcher that I am, holding the worldviews that I do.

A CGT methodology thus provided the overarching structure for this research. In a phased approach (see Section 1.6), a soil science textbook, as well as a curriculum and teaching praxis were first reflected upon (see ‘pilot-like’ studies in Chapters 3 and 6). These prior action and reflection cycles served as data, informing subsequent reflective memoing and contributed to the generation of theoretical insights. While the initial action and reflection cycle underwent

less structured coding, it nonetheless played an important role in shaping the resulting CGT. It was thus integrated within the study's methodological framework. This is congruent with Glaser's (2012:1) dictum: "all is data". This approach was also informed by Charmaz's (2005) CGT perspective, which recognizes the researcher's subjective experiences, both past and present, as crucial elements in the collaborative process of co-constructing knowledge. Subsequently, professional academics – in the fields of soil science, curriculum transformation, and IK studies – were interviewed about their understandings of Africanisation. This was coded and abstracted as per Charmaz's (2005) constructivist grounded theory method (see Chapter 7).

5.4.2 Constructivist Grounded Theory Method

A grounded theory data collection method (often) begins with purposive sampling. That is to say, non-randomised nonparametric sampling in which the researcher intentionally selects sources of data (e.g. interview participants, teaching praxis reflections) that the researcher deems most likely to best answer the research problem (Anderson, 2010; Shah & Al-Bargi, 2013). As this study does not take a deductive approach – in which it is of prime importance that a sample be statistically representative of a population – purposive sampling is appropriate (Wertz *et al.*, 2011; Birks & Mills, 2015). Accordingly, interviews were conducted with a purposive triangulation of differing professional tertiary academics, namely: soil scientists, curriculum transformation specialists, and IK researchers (see Chapter 7). It was deemed that each of these categories of interviewees, while being unsuited to separately answer the research question outright, would collectively be well positioned to provide meaningful data to investigate (using grounded theory) the complex research problem at hand. In practice, participants were sometimes qualified in more than one of these three categories (see Table 5.1). Interview schedules were therefore adapted accordingly (see Appendix 5.2).

Table 5.1: Number of interview participants by expertise category and duration of interview.

Expertise category	Number of interviewees	Duration of interviews
Curriculum Transformation and IKS	9 participants	08h 32m 15s
Curriculum Transformation only	7 participants	08h 03m 38s
IKS only	2 participants	02h 07m 09s

Soil Science and IKS	2 participants	03h 06m 31s
Soil Science only	6 participants	08h 03m 04s
TOTAL	26 participants	29h 52m 37s

A list of suitable academics to interview was made using three methods. Firstly, internet searches were conducted of South African universities for the contact details of academics with these research specialities. Secondly, academics who published prominently in the literature of these disciplines were contacted. Thirdly, snowball sampling was also undertaken, in which interview participants were asked to refer to the researcher other professionals whom they judged would be valuable to interview (Biernacki & Waldorf, 1981; Faugier & Sargeant, 1997).

Over the course of the research, 80 individual academics across the three identified categories were contacted by email and invited to interview. Of these, 26 consented to participate in a one-on-one interview with the researcher – a 33% response rate. Initial interviews were done in person, but due to a global pandemic, most interviews were conducted online. The podcasting platform Zencaster.com was used for this purpose. The reasons for this choice of platform (as opposed to more well-known options such as Zoom or Skype) were that Zencaster: (1) required no software installation by participants, and the interview could be conducted by simply opening the interview invite-link in an up-to-date web browser; (2) had no recording time limitations and was free to use for the purposes of this study; (3) is designed for podcasting and focuses on high-quality audio recording, which was deemed very important for the clarity of transcription purposes; (4) is a voice-only platform which mitigated bandwidth cut-out issues often encountered with video-based platforms. Thus, a total of 29 hours 52 minutes of in-depth interviews were conducted, recorded, and transcribed. See Appendix 5.2 for interview schedules and Appendix 5.3 for a sample of the transcribed interviews.

Grounded theory as a *method* of analysis hinges on the rigorous process of coding qualitative data (such as interview transcripts or researcher notes). Coding is the activity of assigning conceptual labels or categories to portions of the data. The process of coding in grounded theory seeks to transform raw data into information (and ultimately theory) by identify concepts inherent in the data (Dick, 2005; Charmaz, 2006; Creswell, 2012). Bryant (2017:120) sums up the definition of coding as follows: “[coding is] the process of defining what the data is about.

Unlike quantitative research, which applies preconceived categories or codes to the data, a grounded theorist creates qualitative codes by defining what he or she sees in the data. Thus, the codes are “emergent”—they develop as the researcher studies his or her data.”

The mechanism which drives the process of analysis is thus one of coding the data. In grounded theory, the analysis (coding) of data begins once initial data are collected, and before all data are collected. This allows the researcher to become aware of emergent themes in the data; this in turn can direct subsequent data collection. This is termed theoretical sampling (Bloor & Wood, 2006). Data collection and analysis in grounded theory are thus iterative, recursive, and mutually reinforcing (see Figure 4.2). That is to say, as data are collected, the researcher begins to analyse the data (by way of coding and constant comparison) to better direct (refine) subsequent data collection, and so it goes. Coding in CGT is both logical and intuitive. The researcher’s immersion in the process of coding the data allows for conceptual insights into refining the data by way of constant comparisons. Subsequently, codes themselves become data for the ‘next level’ of the coding process. A process of abstraction is undertaken wherein similar codes are grouped (‘rolled up’) into categories. Thus, by iteratively comparing and coding ‘lower level’ codes themselves – the analysis is conceptually raised, by ‘rolling-up’ existing codes into more abstracted conceptual categories (Charmaz & Henwood, 2008; Willig, 2013; Bryant, 2014; Merriam & Tisdell, 2016; Charmaz *et al.*, 2017; Creswell & Poth, 2018). Throughout the analytic process of coding, the grounded theorist writes conceptual notes (called memoing) on the similarities, differences and relationships between codes and between categories. This is a parallel process (see Figure 5.2) which drives and refines the researcher’s reflexive theorising of the results of the coding process (Denzin & Lincoln, 2017). The rigorous repetition of this process ‘distils’ theory from data; or, as Charmaz (2006:71) puts it: “coding begins to unify ideas analytically”. Bong (2002:8) deftly summarises the iterative process of coding as follows: “(1) comparing units of meaning across categories for inductive category coding; (2) refining categories; (3) ‘delimiting the theory’ by exploring relationships and patterns across categories; and (4) integrating data to write theory.”

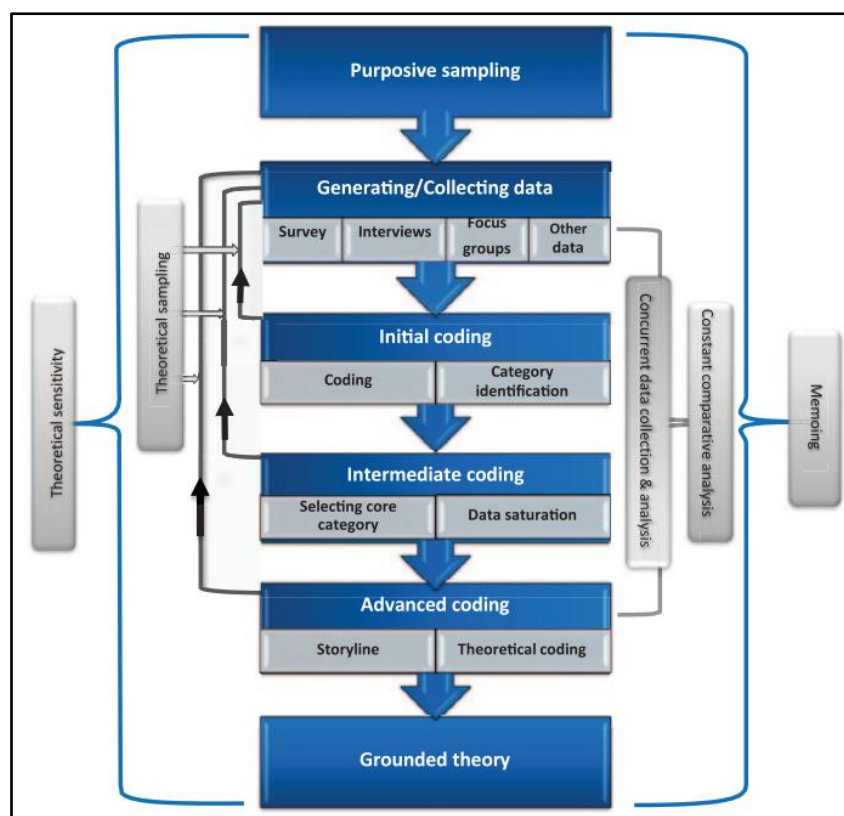


Figure 5.2: The iterative and recursive grounded theory method (Tie *et al.*, 2019:3).

In Charmaz’s constructivist approach, the three levels of coding are termed: initial coding, focused coding, and theoretical coding (Ngulube, 2015). Initial codes are assigned to the raw data by way of the researcher inductively searching for differences and similarities in concepts within the raw data; and the transcript (for example) is coded on a line-by-line basis (Chametzky, 2016). Thus this first level initial coding remains nuanced and ‘close’ to the data (Charmaz, 2006; Tie *et al.*, 2019). Charmaz (2014: 245, 251 & 260) recommends the following questions and flexible strategies to assist in coding:

- What is this data a study of?
- What do the data suggest? Pronounce? Leave unsaid?
- From whose point of view?
- What theoretical category does this specific datum indicate?
- Remain open.
- Stay close to the data.
- Keep your codes simple and precise.
- Preserve actions.
- Move quickly through the data.
- Breaking the data up into their component parts or properties.
- Defining the actions on which they rest.
- Looking for tacit assumptions.
- Explicating implicit actions and meanings.
- Crystallizing the significance of the points.
- Comparing data with data.
- Identifying gaps in the data.

As per Figure 5.2, theoretical sampling is undertaken concurrently while coding and memoing continues. As the process of coding progresses, the researcher strategically seeks out further data they deem relevant (as identified by memoing) to advancing the development of existing, constructed categories. Once this iterative process of coding, memoing and theoretical sampling no longer yields new and meaningful categories, saturation is said to have been achieved (Dick, 2005; Birks & Mills, 2015; Chong & Yeo, 2015; Morse *et al.*, 2021).

Focused coding is then undertaken once initial coding begins to develop categories. This focused coding consolidates similar codes into further abstracted categories of meaning (as identified by concurrent memoing) (Ngulube, 2015; Tie *et al.*, 2019; Lindqvist & Forsberg, 2022). Bryant (2017:212) provides a succinct definition of this memoing-driven categorising as: “the analytic step in grounded theory of selecting certain codes as having overriding significance or abstracting common themes and patterns in several codes into an analytic concept.” The third level iteration of constructivist coding is termed theoretical coding, and aims to (yet again by constant inter-comparison and memoing) further abstract and ‘conceptualize’ the categories into theoretical concepts which have meaningful explanatory power with respect to the research problem at hand – see Figure 5.3. Importantly, it is the researcher’s analytic and pragmatic abductive reasoning which elevates the process beyond simple re-description of the data (Lincoln & Guba, 2013; Bryant, 2019). Thus, it can clearly be seen that, via a chain of codes and memos (evidence) that the ultimate constructed theory remains rooted (grounded) in the data (Urquhart, 2013).

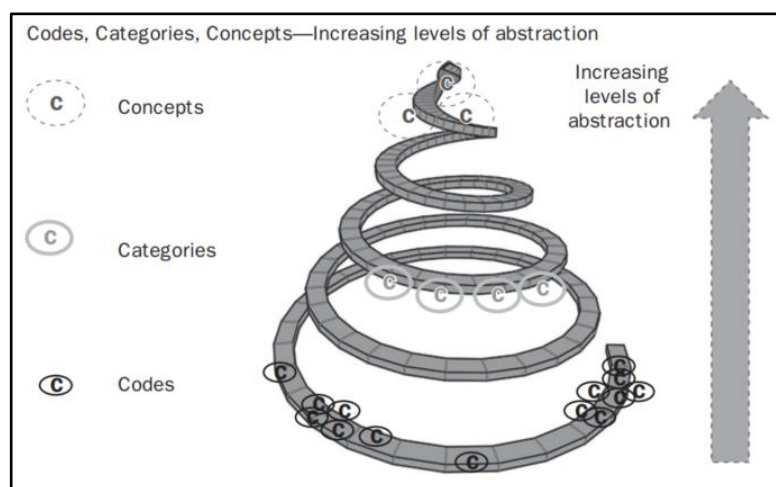


Figure 5.3: The spiral model of grounded theory abstraction (Bryant, 2017:97).

The CGT method was executed in this research in accordance with the aforementioned principles and theory. In this regard, theoretical sampling (Bloor & Wood, 2006) was undertaken, such that initial data analysis guided and informed subsequent choices in data collection (i.e. purposive selection of interviewees). Moreover, a point of saturation (Mason, 2010; Chong & Yeo, 2015) was achieved at ~25 hours of interview data. Accordingly – and to ensure absolute saturation – at the point of gathering 30 hours of interview data, data collection was deemed sufficient and was terminated. All coding and memoing for this research was done manually. Manual coding and memoing was preferred to the plethora (Silver & Woolf, 2015) of Computer Assisted Qualitative Data Analysis (CAQDAS) for the following reasons:

- there is considerable effort in choosing and learning a CAQDAS, as well as the attendant complex data management (Frieze, 2016), and,
- manual coding allows for more finesse and control of the coding process (Chametzky, 2016), as coding is not a ‘precise science’ but is rather a flexible and evolving process (Saldaña, 2016), and the rigour of manual coding can generate high quality results (Foley & Timonen, 2015);
- manual coding allows one to be closer to, and immersed in, the data as advocated by Charmaz (2006);
- the use of CAQDAS may result in grounded theory simply being executed as method without an understanding of the principles of theory generation – which may consequently result in a shallow analysis of the data, which may lack conceptual depth (Bringer *et al.*, 2006);
- there may be difficulties in portraying methodological transparency when using CAQDAS (Bringer *et al.*, 2004);
- using a CAQDAS does not automatically confer sophistication nor technological validity to the coding analysis (Bong, 2002);
- CAQDAS lends itself to more deterministic-type (e.g. Strauss and Corbin style) grounded theory approach (Frieze, 2016); while a CGT approach is used here.

Moreover, the importance and applicability (to this study) of the last point above is singled out for emphasis by Trowler (2010:1):

CAQDAS contains intrinsic dangers, now being realised, of approaches to qualitative data analysis converging as researchers world-wide adopt a small number of CAQDAS packages. The rich diversity of ‘manual’ analysis approaches that existed in the past is stifled by a technologically determined shift, powered by the sets of assumptions built into the software.

Nevertheless, manual coding is exceptionally time and labour intensive. The use of a CAQDAS is also superior in terms of indexing and ‘searchability’ of the data and codes (Coffey *et al.*, 2010; Saldaña, 2016).

Regardless, as Wertz *et al.* (2011:321) puts it: “method is just a way of ordering our capacity for insight—but does not produce it.” That is to say, the dichotomous choice between CAQDAS or manual coding is a misnomer. Rather, as Bong (2002) strongly argues, the choice of *a method* of analysis should not take primacy – but that the analytic framework itself must dictate this choice. Basit (2003) further supports this position by advocating prioritising the theoretical inclinations of the researcher in this choice of method. It was therefore deemed congruent with the choice of a CGT approach, to develop a ‘unique’ and manual coding and memoing practice.

Interview transcriptions were conducted using headphones, and the pause-rewind-replay method to capture the orality of the interview in text. A ‘naturalised’ transcription was thus produced. That is to say, the innate oral nature of the interview was captured, with pauses, incomplete phrases, colloquial interjections, and an oral stream of consciousness sentence structure. This is in contrast to ‘denaturalised’ transcription, where – in the transcribing – the conventions of writing are prioritised over oral formulations of language (Oliver *et al.*, 2005; Nascimento & Steinbruch, 2019). This choice of naturalised transcription is congruent with CGT – as, in retaining the socio-cultural characteristics of the interview, one ‘remains close to the data’ (Charmaz, 2006; McMullin, 2023).

The sum of the ‘total editing time’ on the electronic file properties for all 26 transcripts was 702 hours and 13 minutes (or 29 ¼ full days of transcription). This is consistent with spending on average 3 hours per working day on transcribing (adding up to 234 working days). Similarly, for Level 1 coding, it was noted that on average, 5 pages could reliably be coded in 3 hours. Thus, a total of 533 printed pages (comprising 231 865 words) were manually coded for Level 1, took approximately 13 full days. However, on average, only 3 hours could be dedicated per day to this Level 1 coding, equating to 106 working days. The above quanta are provided as an indication of the researcher’s ‘close involvement’ with the data, as encouraged by Charmaz’s (2006) constructivist approach to grounded theory.

While ‘initial coding’ (also termed Level 1 here) was conducted line-by-line in the margins of the printed transcripts, memoing was done simultaneously (Bryant, 2017) on the blank reverse

side of each transcript (see Figure 5.4). Further reflective memoing was also done in a research journal throughout the coding process. ‘Focused coding’ (Level 2) consolidated initial Level 1 codes (by participant, question number and page) and was transferred into a spreadsheet to increase ease of reference (see Appendix 5.4). As Bowers and Schatzman (2021:118) point out “[the researcher’s] perspective determines which dimensions are irrelevant, relevant, and salient. As perspective varies so too the relevance of dimensions varies.” Thus the resulting Level 2 categories were also annotated with properties, which are distinguishing and/or explanatory characteristics or attributes (Hull, 2013; Saldaña, 2016, Bryant, 2017). The locations of meaningful participant quotes were also correspondingly noted. An idiosyncratic form of focused coding (Level 2) emerged from the researcher’s impulse to facilitate sorting and provide a ‘big picture’ overview (see Figure 5.5). Here, all Level 2 codes were manually laid out and ‘rolled up’, through three iterations of focused coding (Level 2A, 2B, 2C), and then into the final encompassing ‘theoretical codes’ (Level 3) (see Appendix 5.4 for the coding analysis). This iterative coding process ultimately resulted in three theoretical codes, the relationships between which formed the CGT produced by this study (see Chapters 7 and 8).

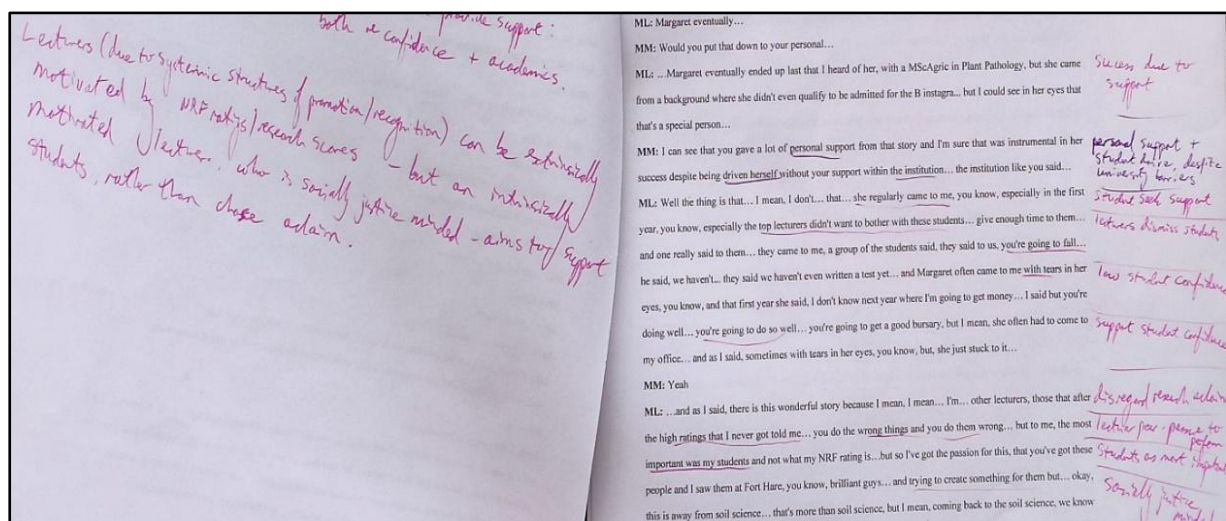


Figure 5.4: A snapshot of manual initial coding (Level 1), and simultaneous memoing.

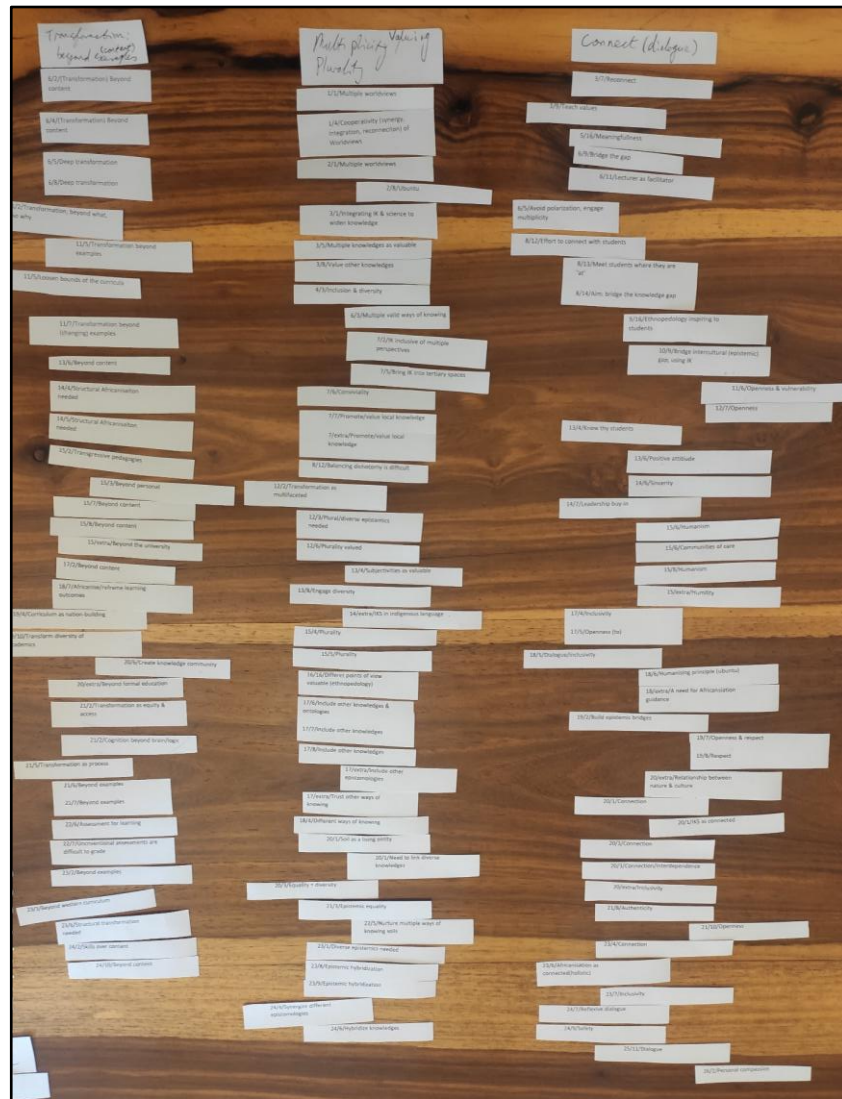


Figure 5.5: A snapshot of manual focused coding (Level 2)

In designing and conducting this coding, Chametzky's (2016:167) axiom for CGT was followed: "trust yourself and trust the grounded theory process." Thus, the research discovered the need for an additional iteration of theoretical coding to further refine, abstract and produce the grounded theory presented in Chapter 8. These multiple iterations of analysis, reflection, and synthesis ensured an epistemic intimacy with the data and a consequent authentically grounded inquiry of the data.

5.5 Research Quality Criteria

The criteria applied to justify the quality of the research within a specific paradigm or tradition is termed rigour and differs significantly between quantitative and qualitative research (Park *et al.*, 2020). In this regard, quantitative research is concerned with the *verification* of results (e.g. objectivity, validity, reliability) (Taylor & Medina, 2011; Rehman & Alharthi, 2016). Whereas, in qualitative research the affirmation of the quality of results is termed *validation*. Importantly, Willig (2013) asserts that the evaluation criteria should be aligned with the research's epistemological framework. Key to this is that – due to constructivism's qualitative search for 'meaning' being subjective – the positivist norm of 'objectivity' is an unfit measure of rigour (Henwood & Pidgeon, 1992; Chilton & Leavy, 2014). Accordingly, the usefulness of the positivist quality criteria of reliability and validity is obviated by the mismatch with constructivism's ontology and epistemic, which sanction multiple authentic perspectives (Howitt, 2010; Lincoln & Guba, 2013).

Guba and Lincoln (1989) proposed appropriate validation³⁸ quality criteria for application in qualitative constructivist research. Primarily, these are (1) trustworthiness and (2) authenticity criteria. Trustworthiness is analogous to the positivist criteria of rigour. Rigour encompasses the aforementioned positivist factors of objectivity (i.e., researcher neutrality), validity [internal and external] (i.e. confidence in the 'truth' of the results), and reliability (i.e. consistency of results). Guba and Lincoln (1989) and Denzin and Lincoln (2017) accordingly suggest 'parallel' [to positivist rigour] trustworthiness criteria for constructivist research (see Table 5.2).

³⁸ Note: Validation as the general approach to affirming the quality of qualitative research, must not be confused with validity, a positivist criterion of rigour (after Guba and Lincoln, 1989).

Table 5.2: Constructivist trustworthiness quality criteria and their parallel positivist quality criteria (after Guba & Lincoln (1989), Denzin & Lincoln (2017), and Cooksey & McDonald, 2019).

Constructivist trustworthiness quality criteria	Description of constructivist quality criteria	Technique(s) to test/fulfil constructivist quality criteria	Parallel positivist reliability quality criteria
Credibility	The faithfulness with which participants' constructed realities are represented by the researcher.	Prolonged engagement; persistent observation; peer debriefing; negative case analysis; progressive subjectivity; member checks.	Internal validity
Transferability	The likelihood of findings being transferable (useful) in similar contexts.	Thick description of the aims and context of the study to aid transferability judgements.	External validity
Dependability	A clear documentation of the emergent process and decisions made during the research.	Dependability/inquiry audit (focuses on the quality and appropriateness of the research process).	Reliability
Confirmability	Research findings are rooted in the data.	Confirmability audit (focuses on the well-documented logical linkages between data and findings).	Objectivity

Even so, there is an issue with these trustworthiness criteria, in that, being 'parallel' to the pre-existing positivist rigour criteria, their epistemic departure point (although modified to fit a constructivist paradigm) is still one of positivism. This is particularly evident in these 'parallel' constructivist quality criteria being predominantly methodological (i.e., the approach inherent in positivist rigour criteria) (Guba and Lincoln, 1989). Thus, Guba and Lincoln (1989) – to ground quality criteria in the constructivist paradigm – developed *authenticity* criteria. They propose five authenticity criteria: (1) Fairness, (2) Ontological authenticity, (3) Educative authenticity, (4) Catalytic authenticity, (5) Tactical authenticity. Nevertheless, as Holton (2008:6) points out “the canons of quantitative and qualitative methodologies do not provide appropriate criteria for assessing the quality of a grounded theory.”

Accordingly, Glaser and Strauss (2006) appropriately developed tailored qualitative authenticity criteria for specific application in grounded theory research. These quality criteria

are: fit, grab, work, relevance, modifiability (Olson & Raffanti, 2004; Charmaz, 2006; Glaser & Strauss, 2006:237-250; Holton, 2008; Bryant, 2014, Ralph *et al.*, 2014; Creswell, 2015; Devadas, 2017; Vander Linden & Palmieri, 2021), which are defined as follows:

- **Fit:** is an evaluation of the integrity of the process by which codes and categories were arrived at by means of grounded theory methods – rather than preconceived codes and categories being imposed from existing theory onto the data i.e. the theory's fit with (or representativeness of) the data.
- **Grab:** is an evaluation of the potential for the theory produced to be understood and 'grab' the attention of one familiar with the substantive research area i.e. the pragmatic clarity of the theory produced.
- **Work:** is an evaluation of the ability of the grounded theory generated by the research to interpret and explain and even predict behaviour in relevant contexts i.e. its usefulness and explanatory power.
- **Relevance:** is the meaningfulness and applicability of the emergent theory to the real-world context it seeks to explain.
- **Modifiability:** is an evaluation of the robust flexibility of the produced theory to remain relevant while being able to account for and adapt to further research and data i.e. the durability of the applicability of the theory over time (not to be mistaken for rigidity).

The research undertaken here is accordingly evaluated in the Conclusion (see Chapter 9) against these quality criteria which are specifically tailored to grounded theory.

5.6 Ethical Considerations and Limitations of the Research

Ethics approval for this research project was applied for with the Ethics Committee of UNISA's College of Agricultural and Environmental Sciences, initially in November 2017. Due to various revisions and resubmissions, final ethics considerations were submitted in October 2018, and ethics approval was granted in May 2019 (See Appendix 5.5, reference number: 2017_CAES_174). The ethics considerations of this research revolve around the principal that respondents consent to participating in in-depth interviews in an informed and voluntary manner. Else the research could prove unethical (Given, 2008; Stacey & Stacey, 2012). For this reason, all respondents to the in-depth interviews remain confidential; identifying data was not collected, and responses have been aggregated in the analysis and discussion chapters. If respondents are quoted in the research, the quotes remain anonymous. Such that these ethical considerations are upheld, free and informed prior consent from participants was obtained and recorded in writing before an interview could proceed (Iphofen & Tolich, 2018). Moreover, if at any stage a participant wished to withdraw from the interview, and/or retract their answers to the interview, the researcher immediately complied with the request by destroying all and

any records of their interview (although no interview participants withdrew) (Israel & Hay, 2006). Given that the target group being interviewed are trained academics, and not a vulnerable group, it was exceedingly improbable that they would be unfamiliar with or perplexed by such ethical considerations. Moreover, the interview schedule focused on their professional curricula and their thoughts on curriculum transformation – and did not target questions of an explicitly emotional nature. Thus, the researcher, prior to commencing the interview, accordingly apprised the respondent of: the purpose of the study, the methods used, any possible risks, possible inconveniences or discomforts of participating, as well as the intended outcomes of the research (Berg, 2001; Israel & Hay, 2006; Tracy, 2013).

The qualitative grounded theory approach of this research has been argued as being most appropriate for addressing the research problem at hand. Nevertheless, as with any research approach, some associated limitations remain. Firstly, due to the rich qualitative data required in grounded theory research, the number of participants which can practically be interviewed is limited. This is because of the significant time and resources needed to transcribe and analyse interview-generated data (Evely *et al.*, 2008). Thus, while the sample size may be small, and generalisability is accordingly limited, a novel grounded theory is produced, which can be tested in other contexts (Timonen *et al.*, 2018). Another criticism levelled at grounded theory is that it attempts to depart from a positivist paradigm in a qualitative context. At its outset, grounded theory touted the idea that the ‘data speaks for itself’ – with theory being ‘discovered’ pre-existent in the data (Glaser & Strauss, 1967). The researcher was thus an ‘uninvolved midwife’ (Willig, 2013). However, a particular researcher (with particular worldviews) actively engages with and ‘surfaces’ the theory in the data. A grounded theory researcher is thus personally involved in shaping the theory that emerges (Charmaz, 2021). It is by way of explicitly acknowledging this subjectivity (see Sections 5.3 and 5.4) that the CGT approach used in this research addresses this criticism. Lastly, grounded theory has been criticised for being prone to researcher bias and preconceptions which may undermine the rigour of the study. In this regard, Glaser and Strauss (2006) and Hussein *et al.* (2014) suggest that while a preliminary reading of related literature is required to ‘sensitise’ the researcher to the existing research landscape, an in-depth literature review should only be undertaken *after* the analysis is done. By this means, the research findings are less likely to be ‘contaminated’ by existing literature – whereby the researcher may attempt to ‘force’ certain existing interpretations onto

the data, and thus undermining the ‘groundedness’ of the theory generated. This guideline has accordingly been followed in this research (as per Section 1.6).

5.7 Conclusion

This chapter has located and detailed the researcher’s worldview and research paradigm, along with the research design, methodology and method selected to investigate the research problem. Importantly, it has been demonstrated that these factors are congruent – making for robust research. Specific details of how the data was analysed were also discussed, along with ethical considerations, limitations of the research, and quality evaluation criteria. The following chapters proceed to present and discuss the theory development and the CGT produced by the research.

CHAPTER 6: TEACHING-PRAXIS AND REFLECTIONS: CONTRIBUTIONS TO A CO-CONSTRUCTED GROUNDED THEORY

6.1 Introduction

This chapter³⁹ comprised an early-stage development of this research project, which resulted from reflexive inquiry into the researcher's then teaching praxis. The chapter describes an initial (partially successful) attempt at Africanising an undergraduate soil science curriculum. The transformation strategy was based primarily on integrating sound pedagogical theory in the curriculum design and delivery, and prioritising South African examples. This aimed at increasing epistemic access (Morrow, 2009), and consequently forwarding Africanisation in an African university. In developing this curriculum, an action-reflection approach supported the curriculum design and teaching practice. Nevertheless, limitations were encountered, and reflection revealed that Africanisation could be further enhanced. Thus, this chapter details the curriculum and then provides a critical review of the researcher's initial experience in transforming a soil science curriculum. These praxis-informed reflections in turn contributed to co-construction of knowledge with interviewees and the subsequent analytical CGT process and its outcomes (see Chapters 7 and 8).

This chapter begins with a description of the curriculum's context of an African university. It then proceeds to detail the pedagogical theory that guided the curriculum's development. The resulting real-world structural design and delivery of the curriculum are then explained. The chapter concludes with valuable researcher reflections and critiques on this teaching praxis. This includes the development of a theoretical 'building block' that aims to conceptualise the process of engaging in the curriculum's transformation. Within the overarching CGT methodology of this research, this comprised a theoretical antecedent which contributed to the CGT produced.

³⁹ This chapter is an adapted version of the published peer-reviewed book chapter: Milaras, M. & McKay, T.J.M. (2018). Action Research Driving a Scaffolded Soil Science Curriculum: Within the Context of Post-First Year Academic Underpreparedness. In *Cross-Disciplinary Approaches to Action Research and Action Learning*. T. Mapotse (ed.). [Chapter 11]. Hershey: IGI Global Scientific Publishing. DOI: 10.4018/978-1-5225-2642-1.ch011.

6.2 Curriculum Context

My initial interest in curriculum design, epistemological access and advancing Africanisation stemmed from forays into pedagogic literature and conversations with my Doctoral supervisor (see Section 5.3 for an elaboration on my positionality and motivations as a researcher). Thus, within the context of a second-year soil science module, I (the lecturer-researcher) undertook to develop the curriculum using two main approaches: that of community of practice (Grant, 2005) and that of action-reflection (McRobbie, 1994). To meet the needs of the post-first year student, the module described here was designed using best-practice teaching principles with a strong focus on curriculum structure. Epistemological support to post-first year students is essential to address the systemic throughput and dropout challenges which universities face (Jacobs, 2007; Chokwe, 2013; Pineteh, 2014; McKay, 2016). Yet the literature is surprisingly silent on the need to assist post-first year students achieve academic success, the intervention contributes to the literature on increasing epistemological access for second year university students (Topping, 1996; Dochy *et al.*, 1999; Struyven *et al.*, 2003). The class comprised ~145 students and were diverse in terms of: race, socio-economic status, gender and were registered for a variety of degrees (science, humanities and education). That said, the majority were black, male, roughly 20 ½ years of age, South African, came from Gauteng and matriculated at rural or township schools that had relatively good matriculation pass rates. In designing this curriculum, it was sought to go beyond standard ‘soil science’ knowledge outcomes, and to embrace explicit academic development outcomes, such as academic writing and team-work. The aim was to thereby foster epistemic access and take steps in the direction of Africanisation.

6.3 Pedagogical Guides: Community of Practice, Scaffolding, and Action-Reflection Informed Curriculum Design

The curriculum design was informed by the community of practice theory (Grant, 2005; Davids, 2014). Within this framework, insiders (the lecturers, tutors) of the discipline work with newcomers (the students) in a way that enables newcomers to become full practitioners of the discipline. The onus falls on the insiders to assist newcomers to gain mastery over the knowledge and skills of the discipline and eventually become insiders of the community of practice. The approach is also draws on the work of Vygotsky (1978), as mediation is done by more knowledgeable insiders (Lave & Wenger, 1991; Wegner, 2000). Within this approach, newcomers are regarded as legitimate peripheral participants, so as to acknowledge their rights and legitimize their expectations with regards to membership of the community.

Soil science, like all academic disciplines has its own ‘way of doing’, such as specific terminologies, ways of writing academically (appropriate phrases and nomenclatures), citing, and mapping. These ways of doing, or what Wenger (1998) calls ‘reification’, must be overtly taught to newcomers. In this regard, the practical component of the module for example, was designed to guide students, using a feed-forward approach, to write an academically appropriate soil science report. The practical sought to share the routines, tools and symbols that comprise the practice of soil science within a safe, supportive learning environment (Wenger, 1998; Sutherland, 2009; Aluko & Hendrikz, 2012). Lave and Wenger (1991) argue that this is essential, as students entering university seldom possess such knowledge, and may unfairly be deemed ‘unsuccessful’ because of this knowledge gap. So, the cultural system, in this case how to write a soil science report and the like, must be brokered by the academics (Wenger, 1998). The ability to broker the artefacts of the discipline in the way that empowers students and builds their disciplinary repertoire, is however not innate. Ways to acquire these educational skills are for lecturers to attend workshops or enrol for qualifications in educational practice, or undertake self-guided reading (Benvenuti *et al.*, 2022).

In addition, an action-reflection approach was enacted to enable the lecturer-researcher actively interrogate and reflect on their teaching practice. This involved iterative cycles of action and reflection, supported by planning and observation. As advocated for by McRobbie (1994:28): “[i]t is the reflection on practice that adds to the teacher’s practical knowledge and it is this practical knowledge that is becoming increasingly important to the change [transformation] process.” This is an engaged and simpatico approach to teaching-research, with an underlying purpose of social emancipation (Brydon-Miller *et al.*, 2003). That is to say, by its cyclical nature, action-reflection approaches support iteration, which develops deepened understanding and more effective action. Amir *et al.* (2017) argue that cycles of action and reflection in an education setting are an excellent way to improve teaching practice. Despite this, they argue that one must take cognisance of the difficulty of conducting research on one’s own practice and indicate that little academic work has been done on this field.

Leitch and Day’s (2000:180) definition of reflection was used, namely “a metaphor for representing a process of learning from experience”. The process followed that of Russell and

Munby (1992:3) and involved the “systematic and deliberate thinking back over one’s actions”. In undertaking this process, the lecturer reflectively interrogated their own (memoed/documented) educational practice, through the lens of the pedagogical literature, and consequently deepened their understanding of their own teaching practice. Over time, the teaching practice was adapted and improved. In this regard, the intervention also adopted what is known as design-based research. This type of research is common in educational settings (Simpson & McKay, 2013). It involved the lecturer-researcher designing a curriculum and various teaching and learning interventions, implemented them, evaluating them and subsequently adapting them ‘on the go’. The aim being to derive “research findings from formative evaluations”, so as to directly and positively impact on the learning process (Collins *et al.*, 2004:16). Thus, there was a focus on “how, when and why” student learning was taking place (Design-Based Research Collective, 2003:5). Thus, the entire intervention fell under a broad but flexible action-reflection approach (McRobbie, 1994), designed to foster student epistemic access to the discipline (Lave & Wenger, 1991; Becher & Trowler, 2001).

One of the core principles of enabling epistemic access and success is the creation of a scaffolded curriculum (as defined by Wood *et al.*, 1976; Morrow, 2007). In this case, scaffolding is breaking down tasks into their basic components, so as to make the skills and knowledge required to complete the task more explicit and provide students with direct learning support where necessary (McKay, 2013). Scaffolding helps students move from the known to the unknown, the simple to the complex. For example, for the soil science report, the various components of the report were disaggregated and students were assisted to complete each component. The notion of constructive alignment also influenced the curriculum design (Biggs, 1996). In this case this was achieved, by making the assessment criteria explicit, and offering direct support for assessment tasks in lectures, practicals and tutorials. Moreover, the lecturer-researcher’s constructivist teaching philosophy is aligned to an action-reflection approach, which co-creates knowledge (see Section 5.3). Thus, the focus was on facilitation, encouraging students to “use appropriate learning strategies”, and enabling deep-learning (Ertmer & Newby, 1993:52). The student is regarded as an active agent where the lecturer facilitates self-directed learning (Banning, 2005). Consequently, students engage in problem solving activities and build on their prior knowledge to make conceptual leaps and connections. Facilitation tools included project-based learning and active class participation (Makgato, 2012). Nevertheless, all constructivist classrooms need ‘ground rules’ to ensure students respect each other, the

process, and take responsibility for their own learning. The classroom must be a ‘safe space’ where students can ask questions and make suggestions without fear (Arao & Clemens, 2013; Barbara *et al.*, 2013). Such ‘ground rules’, focused on respect and engagement, and were established from the start of the module and aimed to reduce disruptions in large classes.

The curriculum was thus designed with specific foundations in established pedagogic theory, with an aim to increase epistemic access and contextualise the curriculum in South Africa – thus comprising an attempt toward Africanisation of a soil science curriculum. The chapter now turns to detailing the consequent enacted curriculum.

6.3 An Enacted Soil Science Curriculum: Promoting Epistemic Access in Support of Africanisation

This section comprises two parts: the first outlines the structural design of the curriculum (as guided by the foregoing pedagogical theory); while the second discusses the teaching approach in enacting the curriculum.

6.3.1. Structural Design of the Curriculum

As previously argued, students need academic self-confidence, and need to be active self-directed participants in the learning process to succeed in a university context (Chokwe, 2013; Amador, 2019). Based on the foregoing theoretical pedagogic guides, the module was thus designed with the following pedagogical aims to foster epistemic access:

1. To create contextualised meaning for students within the discipline’s setting;
2. To impart and develop a positive attitude towards scientific rigour;
3. To model ‘real world, professional world’ skills;
4. To teach academic writing skills within the discipline’s setting.

Particular constraints however – stemming from massification – had to be accounted for. Firstly, the contact time with students was limited. In order to increase time on task under the guidance of a more able peer (as per the Vygotskian approach (1978)), two periods a week (one from the theory, one from the practical) were designated as tutorial sessions. Moreover, due to high student numbers and limited number of tutors (who were final year or Honours students), students were only required to attend one tutorial per week. Thus, each week’s lecture content

was reinforced with activities in the tutorials. Secondly, a textbook, namely: Ashman, M.R. and Puri, G. (2002). *Essential Soil Science*. Oxford: Blackwell Publishing, had already been prescribed. Thus, the lecturer was obliged to use it. Fortunately it did provide a step-wise framework to the fundamentals of soil science, starting with characteristics of soil structure, advancing to soil chemistry, soil classification and ultimately land use and degradation issues. This textbook was nonetheless written from a euro-centric perspective. As a result, important Southern Africa issues such as irrigation, salinity and erosion were neglected, and no attention paid to IK or subsistence agriculture practices whatsoever. Furthermore, significant differences in climate, soil types, slope, agricultural practices and economic capacity of Europe compared to Africa, meant that certain sections were not appropriate. (See Chapter 3 for a decolonial critique of the textbook in a South African context). Hence some sections were omitted, or adapted to take South African soil conditions into account.

Fortunately the lecturer-researcher had the academic freedom to partially adapt the module outcomes. Thus, where necessary, it was possible to contextualise soil issues and deviate from the textbook. These were tentative steps towards Africanisation. As Letsekha (2013:1) so aptly puts it, Africanisation in the context of higher education is “a call to adapt curricula and syllabuses to ensure that teaching and learning are adapted to African realities and conditions.” Accordingly, South African examples were provided to replace the textbook’s euro-centric cases. Such examples included erosion issues; subsistence agriculture issues; and the effects of mining and agricultural land use conflicts. Fey’s (2010) South African soil classification system (which correlates with the World Reference Base (WRB) soil classification system) was also emphasised. The fundamentals of soil structure, chemistry and nutrient cycling were not adapted as these soil processes are canonical to the discipline, operating at faster or slower rates depending on the locale’s geology, topography and climate. In overview, then, the outcomes of the module provided to students were:

- Have a thorough knowledge of basic soil science.
- Be able to explain the complex interrelationships between different facets of soil and the agents (including humans) which affect it.
- Be able to source valid, peer-reviewed scientific articles online, paraphrase and integrate the information into a scientific report and cite the sources correctly.
- Produce a well-structured and coherent scientific report on soil erosion and erosion modelling.

Accordingly, to make explicit the ‘hidden curriculum’ these outcomes were shared with the students in the first lecture (see Cornbleth, 1984). In terms of knowledge and skills sequencing, the module commenced with basic soil science concepts and the physical properties of soils, then, progressed to soil chemistry and nutrient exchanges. This was because such foundational scientific knowledge is necessary to understand how the discipline conceives soils behave under various conditions and uses. Focus then shifted to soil erosion and its severity in South Africa. This explicitly dovetailed into the practical component. Attendant land use issues, with a specific focus on South African agriculture, were then explored alongside appropriate soil conservation measures. Briefly, soil taxonomic systems, and finally soil contamination and remediation measures were considered. There was an overt attempt to explicitly link each section to the previous one, in a step-wise manner, to scaffold learning, build meaning and create a holistic view (see Appendix 6.1 for the schedule of work for lectures and practicals). Morrow’s (2007, 2009) work on increasing epistemic access by scaffolding the curriculum, was an influential pedagogic underpinning to enacting the curriculum.

6.3.2. Teaching Approach in Enacting the Curriculum

To foster discussion and engaged learning, a subverted lecture/PowerPoint format was used in class. That is, instead of dispensing information to passive students, each lecture slide posed questions to which students were asked to suggest answers. Thus, the material was covered by posing questions rather than merely imparting content. This approach was informed by Harland (2012:47) who reasoned that that such a ‘discussion approach’ enables a lecturer to: “(1) enhance knowledge, understanding and critical thinking; (2) help students develop [discussion] values; (3) induct and educate students into a disciplinary community; (4) educate students in the art of discussion.”. Accordingly, students had to prepare for theory lectures by reading an assigned chapter from the prescribed textbook. Students had to either volunteer answers, or individual students were selected arbitrarily by the lecturer and asked to venture an answer. Thus, students were challenged to have done the reading, and make an effort to think of an answer. This was designed to take students out of their comfort zone, into a learning zone (Vygotsky, 1978). Unfortunately for many this was uncomfortable and many resisted this format. In part this may be due to the unnerving experience of no longer being able to passively ‘accumulate’ information dispensed in lectures, but rather involved being forced to critically engage with the material – to both understand it and answer the questions posed. Some also

disliked or were unused to voicing their views in public. For some, a demand for them to be an active participant was a totally new experience.

Consequently, a safe learning environment had to be created to alleviate fears of humiliation in front of one's peers and/or the lecturer (Arao & Clemens, 2013). For example, if a student answered incorrectly, the lecturer-researcher gently said the answer was "not quite" or rephrased the question ("what if..."), or provided leading context ("think about..."). This was to encourage students to examine the topic and find the answer in an exploratory way by internally reformulating their answer and exercising their own learning agency. Additionally, students were allowed to hold 'one minute discussions' with their immediate neighbour. That is, the lecturer posted a question and students could caucus with a peer sitting next to them, before venturing an answer. This was designed to reduce the anxiety by making students feel less vulnerable and more willing to share views as part of a pair. Once the right answer was arrived at through such class discussion, the lecturer then explained concepts in more detail, and encouraged students to ask for clarification if necessary. Overall, the aim was to make students active participants, by speaking about and engaging with the content. They were also forced to take notes in class as the lecturer only made abbreviated lecture slides available.

All students also had to attend one tutorial a week and write an informal 'test' on subjects covered in the lectures that week, so as to consolidate content understanding and foster writing skills. Tutors marked these tutorial tests (moderated by the lecturer), recorded the results (which were low stake, and did not contribute much to the final semester mark, see Appendix 6.2 for the module's assessment plan), and returned the tests to the students. Students received the memo the following week to promote 'assessment *for* learning' (Clark, 2008; Wheatley *et al.*, 2015). The tests were open book, students could discuss answers amongst themselves and consult the tutors. Thus, tutorial tests followed Carroll's (1989) 'time on task' model, where a prescriptive 'time on task' assignment, in a controlled environment, sought to complement and reinforce the theory lectures. The marks enabled the lecturer to track student performance, and making the task for marks encouraged tutorial attendance (as many students would adapt a surface approach to learning and skip the tutorial if the task was not for marks) (McKay, 2016). Assessment was driven by the 'assessment *for* learning' philosophy (Clark, 2008; Tan, 2013). Accordingly formative assessment was used to support learning and not simply to test content

knowledge retention. Thus assessment opportunities were placed at key points in the module, with a particular focus on giving timely feedback, to promote deep learning. This is in line with the assessment philosophy of ‘feeding-forward’ in which: “in order to emphasise continuous learning—feeding back to feed forward [...] students need to have opportunities to make mistakes and to learn from them prior to summative assessment (through formative assessment and feedback)” (Wheatley *et al.*, 2015:1). Moreover, assessments were constructively aligned with the module outcomes (Biggs, 1996). Thus assessment was underpinned by well-researched pedagogical practices.

The practical component of the module accordingly focussed on soil erosion due to its severity, and the consequent social and environmental repercussions, in South Africa (Le Roux *et al.*, 2007). Unfortunately, due to massification, field trips to soil profiles was not possible, so practical activities took the form of a mini-scientific report. The practical was designed with various pedagogical aims in mind. Firstly, it sought to teach intermediate scientific research report writing. That is, whilst the task was more complex than what would be expected at first year, it was also not at the level demanded of a final year student. The practical was designed with a scaffolded approach (see Appendix 6.3 for a structural guide to the practical). This schema and marking rubrics were provided to the students so as to make explicit the ‘hidden curriculum’ of a scientific report. The hidden curriculum are the assumptions and expectations of a curriculum which are undeclared (Cornbleth, 1984). Making them explicit aids students in navigating the curriculum more successfully (Portelli, 1993). The schema also highlighted the logical step-wise argument construction and the accompanying use of sub-headings. The purpose was to ensure that students were aware of how the report would be assessed, to assist their academic access and consequent success. The practical assignment also included learning activities in library and research training, group-work, plagiarism training, synthesising knowledge, and concluded with a reflections on learning exercise – all aimed at fostering the development of students’ critical thinking (Jacobs, 2007; Thondhlana & Belluigi, 2014; Chetty, 2015).

6.4 Research Reflections: Antecedents to a Constructivist Grounded Theory

In the subsequent writing of this chapter for publication (Milaras & McKay, 2018), significant reflection was involved upon the foregoing curriculum design and teaching praxis. Consequently, in the context of the overarching CGT research project, a theoretical ‘building block’ was developed by way of this teaching-research reflective approach. This building block was termed ‘micro action-reflection dialogue’ cycles. In this particular instance the micro action-reflection dialogues were between the lecturer-researcher (lecturer-researcher) and the Doctoral supervisor (co-author). Figure 6.1 depicts the model developed, which is subsequently explained.

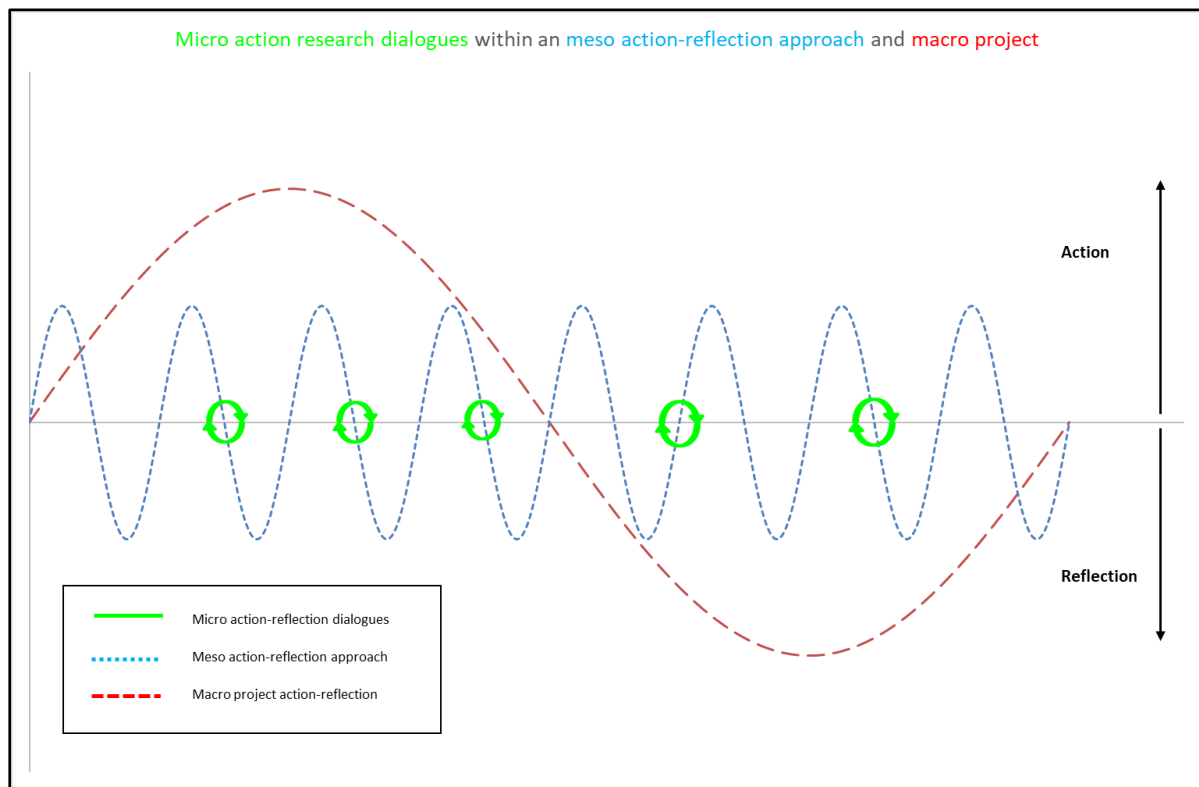


Figure 6.1: Micro action-reflection dialogues driving a meso level action-reflection approach, within a macro research project (Milaras & McKay, 2018).

The enacting of this initial teaching-intervention step toward Africanisation – and the subsequent writing for publication – respectively comprised a macro-cycle of action and reflection. Embedded within this however, were meso or ‘sub-cycles’, comprising shorter cycles of action-reflection. For example, within the action macro-cycle, a meso-cycle could

comprised delivering a lecture (action), reflecting on its efficacy (reflection), consequently adjusting the delivery of the next lecture (action). Or, within the reflection macro-cycle, a meso-cycle could be writing a sub-section (action), and reflecting on the mentor's review (reflection), and so forth. These meso-cycles consequently drive the macro-cycle forward, generate rich reflective 'data', and result in developmental learning. Collectively and interactively meso-cycles contribute to forwarding the macro-cycle and advancing the developmental outcome. The 'energy' of these cycles was generated by the mentor-mentee 'micro action-reflection dialogues' which nested in the meso and macro-cycles. This was informed by Feldman (1999) who highlights the importance of dialogue in driving action-reflection approaches. Micro action research 'projects' have only been informally described in non-academic literature, as a methodology congruent with the philosophy of 'marginal learning gains' (see Elder, 2012). The term is nonetheless used quite differently here – and is thus named 'micro action research dialogues'. These are successive conversations that critically discuss a current issue/task within the context of a meso and/or macro action-reflection cycle – aiming to advance it. Each micro dialogue itself involves action (speaking, drafting) and reflection (listening, reviewing, editing). These dialogues were ongoing and not 'once off', and here, involved the same parties each time. Thus, they underpin and drive meso action-reflection cycles forward, and consequently develop the larger macro action-reflection project.

Figure 6.1 illustrates this conceptual model, outlining how the action-reflection process starts at the meso level (with for example, the first drafting of a curriculum outline), then reflecting thereupon, followed by consequent revisions (further action). At this point, a micro action-reflection dialogue would occur, where critical discussion of the intervention informed the next meso reflection cycle, before the meso action cycle of revising the curriculum again was taken up. Thus action follows reflection, follows action, and so forth. Micro action-reflection dialogues however, were nested within and spurred on both the action and reflection stages (sometimes more than once within each macro cycle). Multiple micro action-reflection dialogues were found to be vital in driving and developing the intervention. Thus, the development and delivery of the curriculum was a 'lived process'. The micro action-reflection dialogues also occurred in the macro reflection cycle of the project; namely, the writing of this chapter. (Whereas the macro action cycle was developing and delivering the intervention itself). In summation, micro action-reflection dialogues occur within, and in support of, a

layered and overarching action-reflection approach, driving meso and macro-cycles of action and reflection.

6.5 Teaching Reflections: Limitations and Recommendations

Reflection afforded the lecturer-researcher insights on the development of this undergraduate soil science curriculum. These range through: insights into the writing and the delivery of the module, to professional academic learnings on educational theory and reflective teaching practice. While the development of the curriculum was documented, due to the high workload of enacting the curriculum, detailed reflections on the teaching process are thinner. Upon reflection, this limitation highlighted that lecturer-researchers could implement a five-minute end-of-day writing practice to document their reflections with more intentionality (Russell & Munby, 1992; McRobbie, 1994).

It was clear, even during the delivery process, that the initial schedule of work was too ambitious (Appendix 6.1). That is, taking a deep interactive and dialogic approach requires a thinner curriculum to make more time for discovery learning and class interaction. This supports the view of Pritchett and Beatty (2012) who remark that the pace of the curricula should be aligned with the pace of learning. Consequently, certain sections (gleyed wetland soils and soil surveys), were culled from the curriculum during the delivery phase. It was also found that more time than was allocated was required to cover basic soil chemistry concepts. With high school science not being a pre-requisite, some students had no prior knowledge to build on. In terms of module delivery, informal student feedback revealed that students were uncomfortable with the subverted lecturing style. They preferred the more familiar, traditional formal lecture style, which rests on the behaviourist ‘instruction paradigm’ which seeks to passively ‘deliver’ information to students (Barr & Tagg, 1995). Thus, the lecturer-researcher’s expectation of responses from students was met with recalcitrance. Perhaps ‘clickers’⁴⁰, as a means to depersonalise the process would be appropriate in future (Caldwell, 2007).

⁴⁰ These Audience Response Systems (ARS) are a technological aid, which allow students in real time to anonymously feedback to a question in class, the results of which can be displayed on the projector screen (Caldwell, 2007).

The tutors and tutorials are another aspect which bear reflection. Tutors were new to teaching and so their marking of assessment tasks had to be scaffolded and moderated by the lecturer. Thus, tutors are also ‘legitimate peripheral participants’, themselves still mastering certain academic skills, and required support and inclusion (Lave & Wenger, 1991). Nevertheless, regardless of the barriers of increased administrative work-load and the differing teaching aptitudes of tutors, tutors do make a material positive difference to undergraduate students’ marks (McKay, 2016). Reflection on the assessment processes showed that students should have been provided with the research report rubrics (Appendix 6.3) *before*, and not just *after* marking. Providing the rubrics to students before submission would have helped to better reveal the ‘hidden curriculum’ (Cornbleth, 1984; Wheatley *et al.*, 2015). That is to say, it may have helped to reveal the lecturers’ expectations and the weightings of various aspects of the report. In particular, the rubrics should have been unpacked and discussed in class ahead of the final submission (Portelli, 1993; Simpson & McKay, 2013).

The lecturer-researcher found that the theoretical underpinnings of the curriculum which was developed, were often more fully understood retroactively. It was only in reflecting on the intervention as a whole that a deeper understanding and, thus, learning was achieved (McRobbie, 1994; Biggs & Tang, 2007). The lecturer-researcher found that significant learning and personal satisfaction was derived from developing the curriculum, delivering it, researching and reflecting upon it. Regardless, this process would not have been as easily accessed, actioned and engaged with, without the supporting knowledge and encouragement of a mentor (Leidenfrost *et al.*, 2011).

Using an action-reflection approach to develop this teaching intervention created additional value for the undergraduate students involved, as well as for the lecturer-researcher. The academic engagement associated with implementing pedagogical theory resulted in professional growth, and initial steps toward Africanisation by promoting epistemic access through a scaffolded curriculum. Thus, it is useful in the Africanisation process for academics to formally engage with boundary hopping between their discipline (in this case soil science) and the theoretical and pedagogical imperatives of education as a discipline. In other words, if epistemological access is to be supported, a module should not only be offered through the lens of that scientific discipline alone. In particular, scientific knowledge and skills are best taught

if a lecturer can come from an informed pedagogical position and be supported by dialogue and cycles of action and reflection.

6.6 Conclusion

Nevertheless, within the broader process of the CGT research project, and subsequent to the interview dialogues with academic experts (i.e. further micro action-reflection dialogues), researcher reflections revealed further limitations of this chapter's enacted curriculum. Primarily, the curriculum fell short of Africanisation of the discipline's westernised epistemic. That is to say, only pedagogic support for epistemic access, and additive local examples were actively integrated into the delivered curriculum. This may have stemmed from (at the time) a shallower understanding of the epistemic social justice aims of Africanisation. This resulted in a lack of more fully apprehending the problematic hegemony of the western science epistemic, and resultant the alienation. As a result, LSKs were not included in the curriculum, with a consequent lack of epistemic diversification and justice. Importantly, these limitations of the realised curriculum, supported the co-construction of the proposed CGT tenets. The following chapter describe this subsequent advancement of conceptions of Africanisation, by way of expert interviews and CGT analysis, which resulted in the tenets for Africanising a soil science curriculum, as developed by this study.

CHAPTER 7: FOCUSED AND THEORETICAL CODES: DEVELOPMENT AND DISCUSSION OF GUIDING TENETS FOR AFRICANISING SOIL SCIENCE CURRICULA

7.1 Introduction: Presenting a Constructivist Grounded Theory

This chapter presents and discusses the codes produced by the focused (Level 2) and theoretical (Level 3) coding and memoing (as described in Chapter 5). The codes are discussed in relation to their groundedness in the data, in light of existing literature, and with existing researcher knowledge. These codes serve as the sub-headings to this chapter, and comprise the guiding tenets for Africanising a soil science curriculum as proposed by this study. It is important to note that, by its very nature, grounded theory is a methodology which results in synthesis (Saldaña, 2011). Thus, this research does not present a results chapter, followed by a findings or discussion chapter. Rather, this chapter describes and discusses the theory-producing integration and abstraction of: interviewee responses, existing literature, and researcher reflections (iterative coding and memoing) – in the production of the focused and theoretical codes. The chapter therefore discusses the foregoing in an integrated manner.

An important strength of grounded theory is the “chain of evidence” (Urquhart, 2013:192), which provides “robust evidential reasoning [for, and] epistemic security [in]” the theory produced (Leonelli, 2020:11). This practice traces the logical source of a code back into the raw data (Miles *et al.*, 2014; Timonen *et al.*, 2018). In this chapter, the chains of evidence embedded in these grounded theory findings is referred to by participant and page number. Thus (P4:9) or P4(9), refers to Participant 4, page 9. This reference refers to either: the page from which a code emerged, or the page from which a direct quote is sourced. If multiple participant-references from multiple pages support a result, they are represented as a list, thus: (P4:9; P8:14,15; P12:11-13). Participant-references thus ground the codes in the raw data of the interviewee transcripts. Focused and theoretical codes are distinguished by italics, e.g. *Personal and Academic Journey* (see Appendix 5.4 for a tabulation of codes and associated properties, by participant and page number).

Classic grounded theory is rigid in its definitions of the properties and dimensions of codes. Properties are the qualitative substance (e.g. ‘shape’ or ‘nature’) of codes, while dimensions

describe a ‘variation in range’ of this qualitative property (e.g. ‘size’ and ‘context’) (Holton, 2008; Hull, 2013; Saldaña, 2016). However the CGT applied in this study, allows for unique expressions of coding which emerge in the process of the researcher closely engaging with the data (Corbin, 2009). Zhang and Wildemuth (2005:2) add that, “[q]ualitative analysis pays attention to unique themes that illustrate the range of the meanings of the phenomenon rather than the statistical significance of the occurrence of particular texts or concepts.” Accordingly, this study did not set out to delineate a frequency analysis of interview data, nor the ‘quantitative’ dimensions of the properties of codes. Attempting to do so did not serve the constructivist nature of the grounded theory applied. Discussed here are the understandings co-constructed (between researcher and participants) during in-depth interviews and subsequent iterative coding of the data (Mills *et al.*, 2006). The findings of this study are thus not described in detailed terms of the frequency of a term or code, or the percentage thereof within a participant group or sub-group. Nonetheless, it was relevant to mention the gross number of participants whom contributed to constructing a focused code, as it was indicative of certain broad patterns in participant responses.

Having laid out the manner in which CGT research is presented, the chapter now turns to presenting the demographics of the participants. This is followed by a discussion of the development and meanings of the focused and theoretical codes.

7.2 Demographics of Research Participants

Before presenting the data as findings, contextualising the data “helps readers understand the analysis” (Urquhart, 2013:198). The demographics of the 26 interview participants are accordingly presented here.

Participants were asked to their age group in decades between 20s to over 60s, as well as their self-identified gender. Figure 7.1 depicts the number and percentage of interviewees in each age category. Notably 54% of academics interviewed were older than 50 years (within 15 years of the normal South African retirement age), while 46% were younger than 49 years. Regarding gender, 11 self-identified as female (42%) and 15 self-identified as male (58%), with zero allied outside of binary gender identifications. Participants were also asked to self-identify their race

grouping. Figure 7.2 indicates that 64% of respondents self-identified as white and 24% as black African; while coloured accounted for 8%, and Indian and ‘Other’, for 4% each. While obviously skewed from national South African demographics (and comprising a small sample size), the interviewees’ demographics are broadly similar to the Council on Higher Education’s (CHE) most recent review of the sector. That is, while there has been a representative demographic transformation of the university student body, academic staffing still lags in this respect (Maphalala *et al.*, 2022; van Schalkwyk, 2022; Hlatshwayo, 2024). Notable here is that a significant portion of academics (and the professoriate even more so) – whom by in large dictate curriculum design – received their education a number of decades ago, in a (then) less critical and reflexive epistemic milieu (Allsobrook, 2014; Soudien, 2015). Research has shown, that if one’s teaching practice remains uninterrogated, teachers tend to teach as they initially observed teaching (were themselves taught) in school and university (Lortie, 1975; Botha, 2020). An older professoriate may accordingly be perpetuating a legacy of positivist and behaviourist teaching and curriculum design – which continues to contribute to student alienation (Naidoo, 2016; Ndlovu-Gatsheni, 2018; Seehawer & Breidlid, 2021). This sense of alienation within the university’s euro-centric epistemic culture extends to non-white academics too (Nathane, 2019).

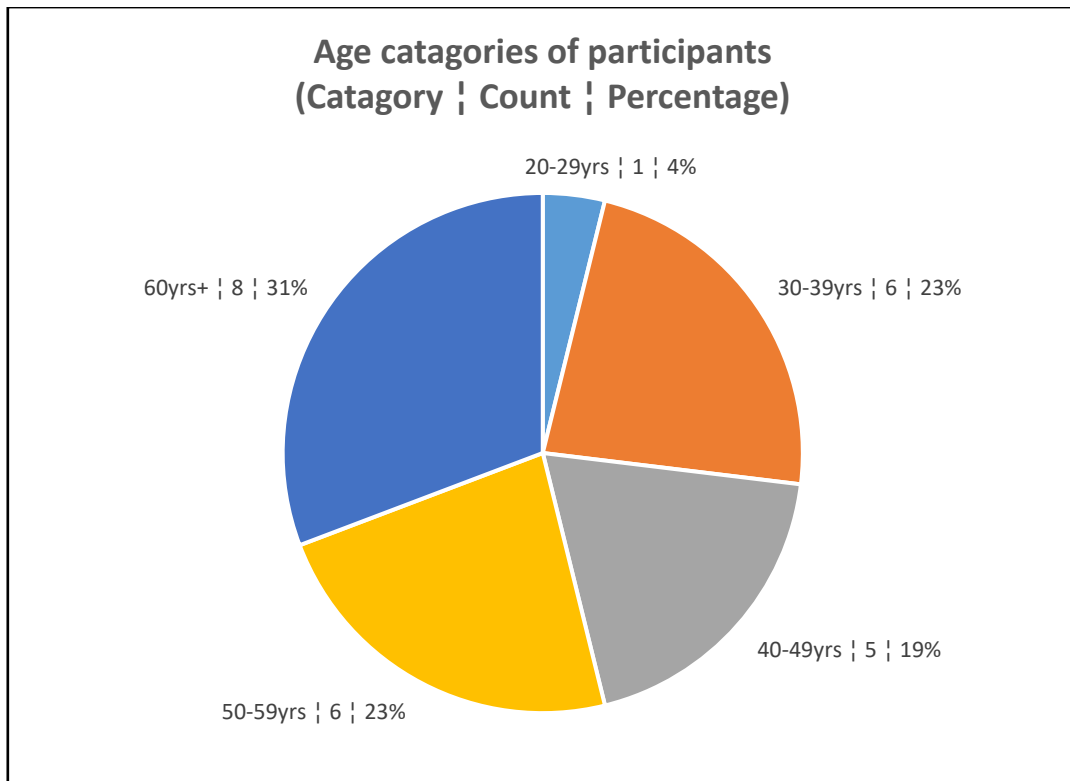


Figure 7.1: Age categories of participants in decades (including count of participants and percentage of total interviewees).

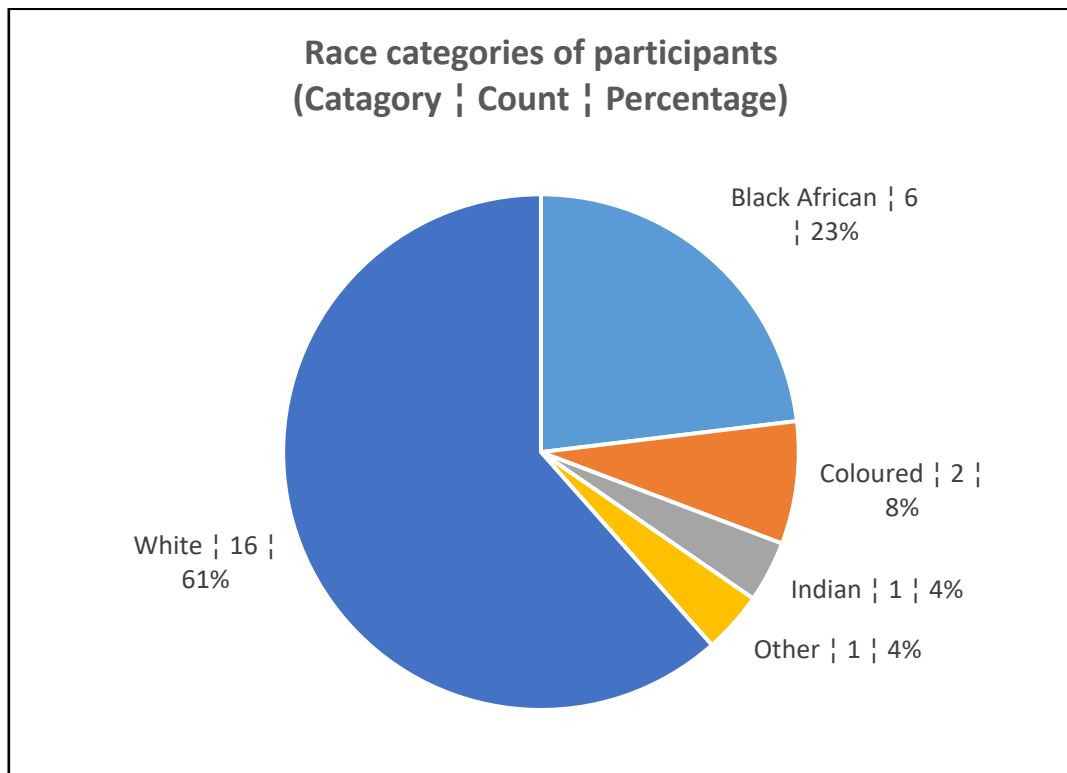


Figure 7.2: Self-identified race categories of participants (including count of participants and percentage of total interviewees).

Participants comprised a diverse cohort in terms of academic expertise, within the sample's parameters (of experts in soil science, IKS, and curriculum transformation). At the time of interviewing 25 of 26 participants held a PhD. One interviewee held two PhDs; while the one holding a Masters degree, obtained their PhD the following year. Moreover, five of the interviewees held two Masters degrees, totalling 31 Masters degrees. Eighteen of the Masters degrees were Science degrees; with 13 of these in soil science, agriculture, botany or environmental science, and another three of those in Science Education. A further six of the Masters degrees held were Masters of Arts or Education. While the remaining Masters degrees were in various related disciplines such as Development Studies, Urban Planning, and Social Science. Thus, a diverse range of academic voices and expertise were included in the sample. Figure 7.3 depicts the broad disciplines in which the participants were awarded their total of 27 PhDs. Due to the diverse titles under which PhDs can be awarded, these were grouped into five epistemologically similar yet distinct categories. Social sciences (18%) for example includes Social Anthropology, Development Studies and Social Science Methods; while Environmental Sciences (30%) included Earth Sciences, Geography, Botany and Wildlife Management. For the purposes of this study, it was nonetheless deemed useful to distinguish Education (15%) from Science Education (18%) degrees; and similarly to not collapse Soil Science (19%) into Environmental Science (30%). There is thus a fair balance of disciplinary viewpoints between interviewees – contributing to the intended inter-disciplinarity of the research. Notably, at certain points, epistemological viewpoints tended to diverge between soil scientists and other participants (see Section 7.3).

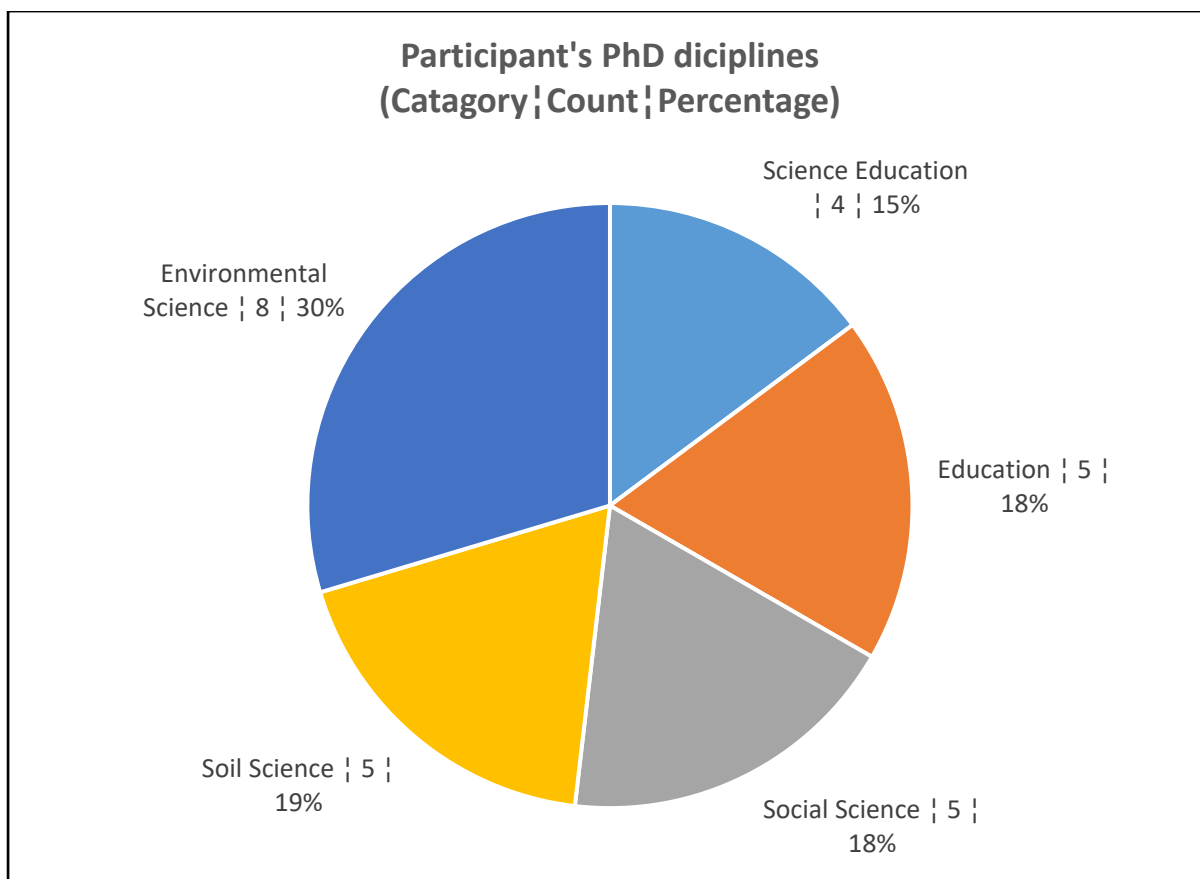


Figure 7.3: Categories of PhD disciplines of participants (including count of participants and percentage of total interviewees).

Participants were asked how many years they had spent 'teaching at a tertiary institution'. While many answered with the precise number of years, some answered with an approximation. At the time of interviewing, respondents had collectively spent a minimum total of 399 years teaching at tertiary institutions. Interviewees were further asked if they held any additional educational qualifications, besides their postgraduate qualification. Two respondents held a PGDip (PostGraduate Diploma) in education (with one additional respondent having started but abandoning a PGDip); while another two respondents held a PGCE (PostGraduate Certificate in Education). Another two respondents mentioned having completed various short courses and workshops in education, while a final respondent held a teaching fellowship. Thus, four respondents (15%) held certified educational qualifications, in addition to their own postgraduate qualification. Thus, as experts in their diverse disciplines, participants has substantial teaching experience which validated the interview data as fit for the purpose of investigating curriculum transformation.

7.3 Focused and Theoretical Codes: Development and Discussion

As discussed in Chapter 5, the data was first coded through initial coding (Level 1) and then numerous iterations of focused coding (Level 2). Subsequently three interdependent theoretical codes (Level 3) emerged from the data, namely: (1) Hindrances to Africanising Curricula, (2) Africanising Curricula as a Journey, and (3) Vision(s) of Africanising Curricula. Figure 7.4 visually depicts the final two iterations of focused coding, which culminated in the three theoretical codes, and the subsequent CGT.

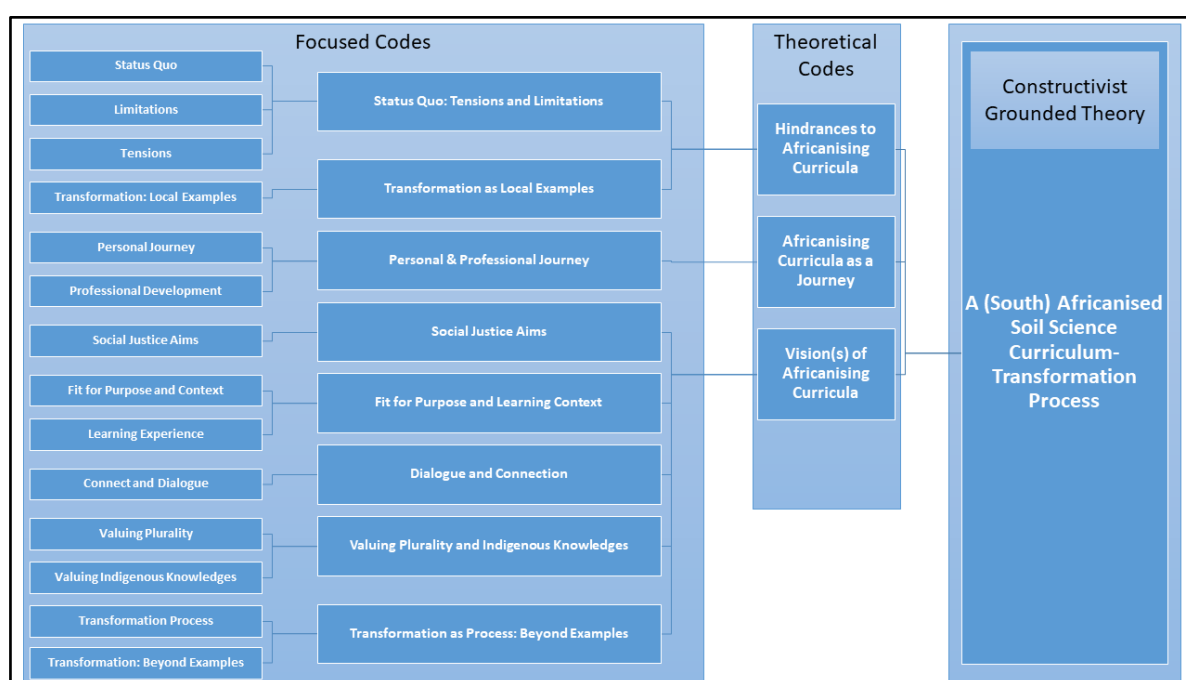


Figure 7.4: Visualisation of iterative coding of focused and theoretical codes culminating in the constructivist grounded theory.

The discussion which follows interrogates the properties of the nine final focused codes that constituted the three ultimate theoretical codes. Following Charmaz's (2006:63) CGT, theoretical codes (Level 3) indicate:

possible relationships between categories you have developed in your focused coding [...] Theoretical codes are integrative; they lend form to the focused [Level 2] codes you have collected. These codes may help you tell an analytic story that has coherence. Hence, these codes not only conceptualize how your [focused] codes are related, but also move your analytic story in a theoretical direction.

It must be noted that codes are not mutually exclusive and often overlap. For example, the code *Hindrances to Africanising Curricula* includes discussions of the marginalisation of IK.

Nevertheless, threats to IK are also discussed within the code *Valuing Plurality and Indigenous Knowledges* – but are related specifically to the context of that code. Where deemed useful to the consequent production of the grounded theory, selected linkages to other codes are reasonably highlighted. Such highlights indicate a link to related concepts, which are further expanded on within that other code. This complexity reflects the subsequent theoretical understandings developed in the interconnected process-based nature of Africanising a soil science curriculum. The characteristics and relationships of the focused and theoretical codes, which comprise the guiding tenets proposed to advance the Africanisation of a soil science curriculum, are now discussed.

7.3.1 Hindrances to Africanising Curricula

From the interview data, it emerged that there were factors that could hold back the Africanisation of soil science curricula. This ultimately produced the theoretical code *Hindrances to Africanising Curricula*. The term ‘hindrances’ was chosen as appropriate, as academics can work to overcome these hindrances. However, till they do, Africanisation of curricula is retarded. This theoretical code comprised two focused codes, namely: *Status Quo: Tensions and Limitations*, and *Transformation as Local Examples*. Details of these focused codes are discussed here in the context of the encompassing theoretical code.

7.3.1.1 Status Quo: Tensions and Limitations

Initiating a meaningful process of Africanising a curriculum requires – as a ‘first step’ – an iterative recognition of the limitations, tensions, and power imbalances that exist between domineering euro-centric epistemologies and the value of incorporating diverse knowledge systems into curricula more equitably. This understanding emerged as the focused code *Status Quo: Tensions and Limitations*. The constitutive facets of the code are discussed here.

An overriding factor which participants argued deterred the Africanisation of science curricula, were perceptions of western science’s epistemic superiority in defining ‘true facts’. Some critiqued this universalising perspective (P1:17; P3:18; P12:2; P15:3,14; P18:4; P19:3; P20:3; P21:2; P22:11), while others subscribed to it (P5:15; P16:8; P25:8; P26:4). This perspective has nonetheless been thoroughly critiqued in this postmodern age (Jarvis, 1998; Glattfelder,

2019) (see Chapter 2). This broad divide tended to be between soil science experts, and the other experts in IKS and transformation whom critiqued the positivist stance in science. Those whom diminished IKS relative to science, claimed that IKS was poorly defined, informal, less detailed, simply comprised local soil names, and does not have a scientific framework; nor, as it is simply relativist, does it meet all parameters to be justified as factual (P5:14; P8:23; P12:2; P16:8,10). P21(9) provided two striking examples of the unquestioned dismissal of IKS:

I had a long discussion with the editor of a scientific journal and he said, no one will ever convince him that there's any scientific merit in indigenous knowledge systems, and he will never publish something on indigenous knowledge in his journal [...In another instance, an article I wrote] got two reviews... one was very positive to say this [IKS] is something different and something unique and something with merit... the other review, and I will never forget it... his exact words were... this author, which is now me, advocates witchcraft, which seems to be popular in the impoverished, illiterate and superstitious South Africa.

In a critique of such biased opinions, P12(22) specifically argued that the epistemically powerful position of western science resists change, as it bestows legitimacy and the power of wielding 'the truth' to those who conform to its epistemic, and thereby reproduces its system of power. Others variously framed this resistance to a diversity of epistemics as: a fear of the unknown and an obsession with being correct (P3:18); the discomfort of questioning hegemony (P4:14); scientific peer-pressure to conform to the disciplinary canon (P12:2); essentialism as toxic to diversity (P12:9); science as a system of exclusion (P15:5); and its blindness to other knowledges (P20:6). One soil scientist objected to the calls for the Africanisation of scientific disciplines, by expressing that it made them "angry" (P5:22). While P16(9) argued that LSKs would need to be validated to a "sufficient [scientific] standard" before being included in the curriculum.

In turn, such dominance of the positivist epistemic manifests as a disregard of local contexts, histories, and the global diversity of epistemics and value systems (P2:15; P5:13; P6:3; P15:11; P18:4; P20:3). In this regard, P20(4) critiqued scientific soil classifications as follows:

[scientific] soil classification or land classification [...use] horizons that are beyond [(below)] the superficial [(surface)] soil to classify, [...] Why? Because it's a genetic understanding of soil behaviour, soil evolution, soil development, [...] while peasants, farmers use the first one meter from the superficial level to try to understand the soil's behaviour and [...] mainly soil's health [...] so scientific soil classifications and let's say farmers soil classification systems or indigenous [...] soil knowledge, soil classifications, we're dealing with different issues [...] for farmers, it's more important to recover the soil health, fertility, [...] not just productivity, but, fertility, etc. etc. in order to balance the soil behaviour... while

soil scientists were at the bottom of a soil pit, [...] doing their jobs and not thinking about the strategic issue to understand the first horizon of the soil... which is more dynamic, and that is why, they wouldn't have wanted to do deal with very dynamic horizons, [as] they were more interested in stale and long standing, processes of soil evolution and soil development.

Thus, the positional authority of the western scientific lens can obscure the value of embedded contextual knowledge, and thus reinforce its power as arbiter of 'true' knowledge, which in turn perpetuates negation of epistemic diversity (P15:6; P19:3). This can result in a disregard of the politics and power dynamics of knowledge generation (Linn, 1996; Allsobrook, 2014). Illustrating this, P16(9) for example claimed that, "[I am] not involved in history or political science or anything" (see link to *Social Justice Aims*). In the university, the valuing of universal science, over socio-politically complex local contexts, becomes visible as a neglect for indigenous and student knowledges. This can result in student alienation from the university curriculum and deficit thinking toward students, with attendant negative consequences on learning (P6:18; P15:5; P17:3; P18:4) (Luckett, 2011; Cullinan Cook, 2019; Naidoo *et al.*, 2020; Motala *et al.*, 2021; Letsekha, 2022; Knowles *et al.*, 2023). Thus, that science can be deemed the sole arbiter of 'truth', is a hindrance to the epistemic inclusivity needed in Africanising curricula in a discipline such as soil science.

Further to science's domineering mono-episteme, curriculum and pedagogical constraints were identified as significant hindrances to transforming soil science education. Participants expressed concerns about narrow and prescriptive curricula – which as a consequence, overstressed rote learning, and undermined critical thinking and problem solving (P1:15; P6:19; P9:11; P26:17). Soil scientists listed conventional assessment methods which were heavily reliant on tests and exams; and additionally, due to massification fieldwork had been greatly reduced, if not cancelled (P5:4; P8:7,23; P9:9; P16:4; P25:5,12). Such individualistic assessment can fall short of for fostering critical dialogue and practical skills (Seehawer & Breidlid, 2021). Seleke *et al.* (2019:364) for example, argue that assessment in transformative problem-based learning should integrate IK to "be 'context sensitive' and assist learners to be skilful and professional in their field of study." The teaching of soft skills such as communication and collaboration were also deemed lacking (P5:18). P26(17) specifically critiqued academics "[that are] so specialised that they cannot see the thing [a problem] in perspective [context], so they can't interpret the results". Similarly, while necessarily experts in their disciplines, academics are often not trained in pedagogy (P6:18). P17(3) provided an

example of this shortfall, in relating that “discovery learning [...was] heralded for a while and then I think because teachers themselves didn’t have those skills [...] it lost favour and we’ve kind of gone back to a much more prescriptive, measurable curriculum.” Moreover, resources which should support teaching and learning were also identified as a hindrance. For example, textbooks were acknowledged as having prohibitively high costs in a South African context, were limited in local relevance, and could be too theoretical (P8:15,18; P9:14,18; P25:6; P26:19). For example, P9(14) explained that the uniqueness of South African soils made international textbooks inadequate for teaching:

most of these texts, they are from abroad... and the if we are to use the classification systems, for example, volcanic soil, they really deal with the soils, developed in temperate regions, the ice soils, crystals and volcanic soils and so forth and some of those soils, you don’t even find them in South Africa, we have our own soil that suits our condition. So, using those texts, it becomes a bit useless at times.

Locally suited, pedagogically sound soil science textbooks, which can be an important teaching (as well as learning) resources, are lacking in South Africa, and there is little incentive or profit in writing them (P26:11) (Love, 2012). Moreover, the official South African soil classification guidebook (SCWG, 2018) (which many soil science lecturers teach) are scientific taxonomic rulebooks, and not teaching aids (P8:19; P26:19). P24(2) concluded that the curriculum is “a social construct [that] can have both positive and negative effects”. Thus, in the South African university setting, these educational constraints fail to create a teaching and learning environment conducive to Africanisation.

Beyond enacting curricula, participants indicated structural and organizational constraints in the university that impede curriculum transformation. P12(14,15) argued that a significant, but often unacknowledged problem, are the meso- and macro-scale constraints which undermine Africanising curricula at the micro-scale. Unequal power relations between disciplines, demands for internationalisation, competitive global university rankings, externally dictated funding priorities, and prescriptive quality assurance policies are often not supportive of Africanisation, and can thus constrain academic freedom in curriculum development (P12:14). Notably, internationalisation and Africanisation are not necessarily at odds. As, without a strong local knowledge culture, there would be no unique contribution to offer international partners; therefore, a robust local episteme strengthens the value and impact of international collaborations Letsekha (2013). Nevertheless, this balance can remain challenging to translate into policy and navigate in practice (Botha, 2010). Moreover, the enlightenment-styled

university in Africa – as self-appointed validator of knowledge – is not traditionally inclusive of diverse external voices, such as those of community IK holders (P1:15) (Ndofirepi, 2014; Mbembe, 2016; Naidoo *et al.*, 2020; Letsekha, 2022). Similarly, the disciplinary ‘border crossing’ required in advancing an Africanised soil science within the hierarchical university, can also be hindered by adherence to the culture and values of disciplinary ‘tribes’ and their epistemic ‘territories’ (Becher & Trowler, 2001; Hoadley, 2010). Such conventions are more ridged in the sciences, which is likely why the humanities have engaged more with the complexity of postmodern concerns (Morreira, 2015). However, Africanisation of curricula is not easily measured – making it difficult for management to discern progress. This can problematically result in managerialism and weak transformation, comprising ‘lip-service’ and ‘box-ticking’, rather than fundamental Africanisation (P14:5; P15:3; P18:3,9; P21:9; P26:31). P13(10) illustrated the problem with ubiquity of quantitative performance measurement approaches:

how are you going to measure your impact on transformation? [It should be] social criteria... not in terms of numbers, but beyond numbers, in terms of what transformative aspects you’ve contributed to... for example, have you contributed to developing new ways of thinking about a certain subject? Have you build bridges between the way we look at knowledge, for example, between academics and non-academic actors? [...] so I think these are some of the questions that could be posed, not in terms of numbers to say... have you graduated ten black students? Something like that... no, but is your curricular responsive to the needs...

Consequently P13(9) indicated that committed leadership is required to change institutional policies and culture. Nonetheless, P14(5) warned that the Africanisation project could also be co-opted for political aggrandizement.

Participants also indicated that the prevailing ‘publish or perish’ university culture which values research over teaching, also prejudices the time and resources needed to Africanise curricula (P12:22; P26:13) (Sebola, 2018). Added to this, there is a shortage of academic soil scientists, particularly young ones who may be more willing to newly develop Africanised curricula (P5:22; P25:14; P26:11,29). This was echoed by P13(7) who shared their experience:

I don’t want to over generalize here, [...] but from my experience, I think it’s more of the new academics, young academics who really want to engage on these issues [of Africanisation]... the old ones tell you, ah look, I’ve only have five years to go, I can’t start engaging in transformation issues, they won’t be helpful to me.

Massification, high student-staff ratios, and consequent heavy work-loads, were also cited as major structural hindrances to there being capacity for individual academics to Africanise their

curricula (P5:7; P6:19; P9:11; P25:12; P26:17). P9(11) contextualised this in terms of the difficulty of developing authentic assessment of the curriculum:

that's the first challenge... the huge numbers, by the time you reach the three hundred [student scripts] you'll be so exhausted, so it takes so much time, without giving them feedback [...], the numbers probably they are the major, major setback in terms of the challenges [to Africanisation].

In this regard, Msiza *et al.* (2020) argue that despite massification, assessment should contribute to learning, rather than simply fulfilling certification purposes. Students' poor English proficiency was indicated as a barrier to learning by some (P5:5; P9:11), while others have critiqued it for being the prevailing language of instruction at university (Jacob *et al.*, 2015). Thus, in the South African university, there are deep-seated structural constraints that hinder transformation projects such as the Africanisation of curricula.

In the process of advancing the Africanising of a soil science curriculum, a special-case limitation was identified. This emerged as its own code, and is discussed in the subsequent section, namely: *Transformation as Local Examples*.

7.3.1.2 Transformation as Local Examples

This code emerged from participants whom maintained that a science cannot be Africanised, beyond the incorporation of local, practical examples. The code emerged solely from the interviewee group of soil science experts. In this vein, P9(22), P16(12) and P26(23,24) maintained that while local examples are important, the universal principles of soil science could not be Africanised – but rather, that the local environment results in a unique manifestation thereof. Similarly, P5(1) held that the scientific aspects of soil science cannot be Africanised because: “soil science is a proper science, [...] it's not something that you'll pick up along the way, it's pure science, it's pure physics, pure chemistry.” And P16(9) likewise argued that LSKs would need to be validated by soil science to a “sufficient standard”, before being included in the curriculum.

Consequently, in their view, P4(12) and P16(12) indicated that the Africanisation of a soil science curriculum would purely comprise foregrounding local soil names and site-specific practical examples. P25(9) and P26(23,24) highlighted their reason for this: South African soils

are incomparable with EU/USA soils; thus an emphasis in the curriculum needs to be placed on local soil conditions. In turn, P5(16) and P26(2) argued that such local examples engage South African students, as they connect to students' personal experience and/or knowledge. For example, P5(16,17) argued in favour of their existing soil science curriculum:

I would make a strong argument that it's already Africanised. And I'll use names like Manguzi and Makhazana and all those [local] names for the soils to highlight my point. If I were forced to expand it [the curriculum], I would certainly include a section on ethnopedology, where you know, just use local names for different areas in South Africa. [...so,] I'm aware of it [ethnopedology, but] to include it at undergrad level, not really, except for explaining and for those nice words that you use to [...] to familiarise the students with [soil names]... and I mean I use that for the Afrikaans students as well, [...] they would talk about a "turfgroond" [...] which is basically a strong, vertic soil, but if you talk about a vertic soil, you know it's just blank stares, but then you say it's 'turfgroond' and suddenly they light up... or 'watertafel-gronde'... water table soils of the Western Free State and people know about the water tables, so it's not only for African [students].

P26(2) further pointed out that this emphasis on local soil conditions highlights for students why the curriculum is relevant (has meaning) in their lives:

... you can mention an interesting American example and the students just go blank[...] the moment you will say, okay, I've seen this here in this [South African] district here, and they will light up and you know, some would say yes, I've seen that on my father's farm or on my uncle's farm ... so that is something that to me is absolutely not negotiable ... our circumstances [environment and soils] are so different, we must use South African examples.

With South African students trained in what is locally relevant, P25(9) and P26(2) argued that future soil scientists could find local solutions to local problems.

In terms of the international soil science textbooks available, P8(18) did not consider them useful for Africanised teaching, as they lack local South African examples, and are too theoretical. Similarly, the FAO WRB and USDA soil classification systems were critiqued as unsuitable for classifying South African soils. This was due to significant differences between South Africa's soils and those used to develop these international standards. Moreover, this poor-fit is compounded by these systems' complexity and the expense of laboratory analysis required for their application (P9:24; P16:9). Rather, South African soil scientists use these systems primarily for international collaboration and academic publications (P8:21; P16:4). As a consequence of the foregoing, these international classifications were not considered useful for undergraduate teaching in South Africa (P25:4).

Following from this, P5(12) and P16(9) deemed the South African Soil Classification Handbook (SCWG, 2018) as Africanised, as it was developed in and for South Africa. Therefore, P8(20) deemed it pointless not to teach it, as it is the official South African soil classification standard. P16(9) further argued that the South African system is morphological, and thus suited to field work, with little laboratory analysis being needed. Moreover, P5(10) explained that the most recent 2018 revision of the official handbook, shifted its epistemic from agricultural ends, to environmental science and land use management priorities. In the discipline at large, this epistemic shift occurred in the late 1990s (Landa & Brevik, 2015; Sigl *et al.*, 2023). It was further noted that this official soil classification is primarily for communication between professional soil scientists (P8:22). P5(17) added to this sentiment, stating: “I am producing a soil scientist... and that soil scientist then must learn how to convert this soil information into extension information. I don’t see that as my job.” Thus, there is a perception amongst participating soil scientists that the objective practice of the discipline’s science is divorced from its South African social context.

Nevertheless, including diverse local soil names, to cater for a diverse student cohort, remains an important first step in Africanising a soil science curriculum. However, it does not go further in questioning the positivist (and universalising) epistemics of the discipline’s canon (see linkage to *Reflection: Questioning Deeply*). In this regard, Morrow (2009:37) argues that “[r]esistance to curriculum transformation can very often reside in the inability of academics to disconnect the relevant epistemic values [(e.g. of western science)] from the particular content in terms of which they gained an understanding of those values.” That is to say, it not acknowledged that, beyond synonymous names, LSKs have different and valuable epistemics which underpin them (Critchley & Netshikovhela, 1998; WinklerPrins & Sandor, 2003; Hilbert & Soentgen, 2021) (see linkage to *Transformation as Process: Beyond Examples*). These forgoing views align with the positivist perspective that the western scientific epistemic is superior to all other ways of knowing, as it holds the monopoly on discerning ‘truth’. Such claims have been critiqued in the literature, for *inter alia*, marginalising African and other ways of knowing, with unintended social and environmental consequences (see Chapter 2) (Kirby, 2013; Ndofirepi, 2014; Haavelsrud, 2015; Soudien, 2015; Mbembe, 2016; Irzik & Kurtulmuş, 2024). Moreover, it is not possible to practice soil science value free; as, to become more socially just in South Africa, it must necessarily engage with the complexities of the country’s unequal social context (Blaikie, 1985; Showers, 2006; Payne, 2010; Bjornlund *et al.*, 2020

Ebhuoma *et al.*, 2022). This context includes engaging with LSKs which are valuable beyond localised examples of soil names (WinklerPrins & Barrera-Bassols, 2004; Pérez-Rodríguez *et al.*, 2023). Fairhead and Scoones (2005:33) for example argue that there is “[a] need for an approach to the study of soil fertility that engages more comparatively with local knowledge, and appreciates the *social* and *moral* orders which shape the ways both African farmers and western agronomists use and understand soils.”⁴¹ Ethnopedologists have accordingly argued the need to go beyond a passing recognition of the Corpus of LSKs, and for the Praxis and Kosmos of LSKs to be meaningfully respected for valuable place-based synergies with soil science to be possible (Barrera-Bassols & Zinck, 2003; Toledo, 2022). In this regard, Stevenson (1996) contends that unless there is an equitable involvement between scientific and local knowledge systems at every stage of an intervention’s planning, achieving long-term sustainability is not possible.

Moreover, and in terms of a curriculum, it has been argued that a simply additive approach (such as affixing local soil names) to multicultural education leads to a superficial engagement with the content, failing to address the deeper reasons for student disengagement (Schilmoeller *et al.*, 2018). Despite facing institutional hurdles like rigid curricula, performance-driven pressures, high-stakes testing, and throughput requirements many academics still strive to support their students’ learning well-being (Ryan & Deci, 2020). In supporting such a commitment, Matthews (2019:59) concludes that:

[t]ransformation and decolonisation of the curriculum is not viewed simply as a matter of changing euro-centric content with South African and African content; it looks at destabilising the authorial voice of control, debriefing teacher-centred education, creating dialogues and conversations about the curriculum, locating discursive and creative spaces for student learning, opening up tertiary education [...], and creating spaces for discussion, negotiation, communication and interaction. [...Africanisation and] decolonising the curriculum entails both looking at the existing curricula differently (rather than simply discarding them) and also opening up space for other kinds of knowledge to be attended to at our universities.

Thus, to produce soil science students who can meaningfully and effectively operate in local contexts, an Africanised university discipline would engage them to respect and integrate diverse knowledge. However, a long-standing positivist canon and the other aforementioned

⁴¹ Italic emphasis added.

hindrances, would need to be overcome in order to advance Africanisation of soil science curricula.

Importantly, it is the recognition and understanding of these limitations (to Africanisation) that can enable academics to explore ways to move beyond them (see *Vision(s) of Africanising Curricula*). In other words, the apprehension of limitations creates the possibility for such limits to be overcome. For without acknowledging a limitation, there is no motivation nor trajectory which seeks to overcome it. Thus, limitations can be viewed as affordances for transformation. This nonetheless, requires a process of personal and professional development to come to value other ways of knowing and being. Accordingly, the emergence of the code which designates this ongoing journey, as the process of developing as an African academic, is discussed next.

7.3.2 Africanising Curricula as a Journey

The foregoing theoretical code *Hindrances to Africanising Curricula* is an important departure point to embarking on a personal and professional journey to becoming an academic in Africa and engaging with the Africanisation of curricula. The journey, by its nature is ongoing. As new limitations are iteratively encountered in one's conceptions of Africanising curricula – academics can engage them as opportunities to find ways to successively transcend them. The theoretical code that emerged, thus depicts the Africanisation of curricula as an deepening journey of engagement with the local context and other epistemics. Iterative reflective encounters with one's limiting beliefs – about what is possible and meaningful in Africanising a soil science curriculum – constituted an ongoing personal and professional journey. In other words, recognising limitations can prompt personal and professional journeys – resulting in transformed thinking and consequently curricula. This journey is thus a transformative experience which can produce ever more socially just curricula.

7.3.2.1 Personal and Academic Journey

The focused code *Personal and Academic Journey* emerged from all but one interview. The primacy of this code is evident in that it became integral to the grounded theory produced (see Chapter 8). This code highlights the highly individual journey that each interviewee

experienced in becoming the academic expert they are (be it in soil science, curriculum transformation or IKS) and their associated views on Africanisation. P1(1) framed this ‘personal journey of becoming’ as a series of “pivotal moments”, which by their nature, are unique. Importantly, this personal journey shaped their worldview and informed their perceptions of, and responses to, Africanisation and curriculum transformation. The importance of one’s personal journey as also been viewed as key in other grounded theory and Africanisation research projects (Charmaz & Keller, 2016; Keane *et al.*, 2016).

For some participants their childhood upbringing was key in shaping their journey as they perceived it. These included childhood experiences of other cultures and worldviews (P2:2; P17:1), experiences of farming (P8:1; P25:1; P26:2), being raised within IK worldviews (P14:1), poverty (P26:2) and experiences of shame, low self-esteem, marginalisation and segregation (P1:1; P15:1; P24:1). P25(1) conveys the lasting impact of such childhood experiences: “when they started ploughing the land in those days and you smelled the soil, and you see the fertilizer and the seeding and the fertilizing being applied... and that’s where it all starts.”

For some their journey was explicitly attributed to an intrinsic curiosity and desire to learn (P2:24; P5:1; P10:1; P17:1-2; P21:1; P22:1; P23:1). P21(1) for example shared that “I believe one should be a lifelong learner”. While for others, extrinsic factors such as: employability (P8:1-2), career guidance (P9:1) and career path (P10:1), university entrance requirements and structure of undergraduate degree (P9:1), mentors (P18:1), bursaries (P8:2; P14:1; P26:2) and opportunities for fieldwork (P20:2; P21:1; P22:1) and postgraduate studies (P2:2; P13:2; P16:1; P17:1; P20:2; P21:1; P22:1; P23:1) were highlighted as pivotal moments in their personal journey as a professional academic.

An opportunity to teach or tutor was another notable extrinsic factor which initiated some participants’ academic journey (P5:2; P8:3; P16:2; P18:1; P26:7). P18(1) exemplified this in their statement:

I don’t think I ever really had an interest in curriculum transformation, but part of supporting the student is also seeing them in context and a lot of their difficulties are often linked to the curriculum [...] through that experience and working with

learning developers [tutors], [...] I started seeing the need to do research in this space and to sort of critique or question some of the things that are still being accepted by so many.

While P13's Post Graduate Diploma in Higher Education (PGDip) catalysed their academic journey as follows:

That's when I did the different modules that were exciting and fascinating to me, teaching and learning, you know, curriculum development, assessment and so forth [...] during that course, I kind of realized that this is actually very useful in the work that I do as an academic, as a teacher, [...] I felt that there were a lot of assumptions that were noticed out when I went to teach (laughs) [...] I just thought, oh well, this is the way I was taught... I'm gonna do the same without thinking critically about how that is experienced, whether or not actually, we actually teaching something that is fit for purpose... so yeah, I then started pursuing issues in around curriculum transformation and [...] that's how it started... and I think it's fulfilling to me (P13:2).

It can thus be seen that a range of lasting affective childhood experiences, intrinsic curiosity, and other extrinsic factors were seminal in the directing of participants' personal journey toward their becoming academic experts (McKenna, 2004; Ryan & Deci, 2020).

Interestingly, there was overlap in some participants between these intrinsic and extrinsic factors (P10; P14; P17; P21; P22; P23). For example, a seemingly extrinsic factor such as further academic studies catalysed a deep curiosity – such that their ignited intrinsic curiosity further fuelled their personal journey, as plainly illustrated by P23(1,2):

I was a masters students [in an] Education Institute... and I had an anthropology teacher... she was talking about medical anthropology and she talked about the fact that [...] understandings of health and wellbeing aren't the same worldwide, but that different people in different places of the world have different conceptions of what it means to be healthy or sick, or [...] about what the disease is, and [...] I sat in that class and it just really came to me with a bang, but this must be true for education as well, how [...] can western education practitioners [...] have an assumption of [...] education as something that you can spoon feed into people... and then [they] will stop being poor [...] that sort of education medicine will cure them out of all misery... after that class, I went into the library of that Institute and [...] started seeking for literature... and then I found a couple of books on African indigenous knowledges, and I started reading on it and I couldn't stop [...] that's 12 years ago (laughs) and [...] I am still reading, [...] that was a big aha moment not to say a shock.

This clearly demonstrates that these catalytic and motivating elements which seed and spur participants' individual journeys are multi-layered and interrelated, rather than clear-cut

mutually exclusive intrinsic and extrinsic factors (Hemmings & Hill, 2009; Leibowitz *et al.*, 2017).

Numerous participants also voiced these experiences of being exposed (often through postgraduate studies in education or IKS) to new and contrasting ideas and worldviews which inspired their curiosity (P2:3, 24; P3:1; P13:2; P21:1; P22:1; P23:1). P2(3) for example explained that until they encountered educational and philosophical theory, that they had no words of their own for ‘worldview’, ‘epistemology’ or ‘ontology’. This lack of vocabulary had limited their deep apprehending of the social divisions they saw in South Africa. However, in widening their epistemic horizons by ‘discovering’/accessing this philosophical language, they began to make meaningful (for themselves) sense of the societal disconnects they had always perceived. While P8(2-3) and P22(2) explained that experiences of IK during their postgraduate fieldwork respectively highlighted an expanded understanding of others’ worldviews of soils, and internal inconsistencies within WSS:

I think I learned quite a bit of the way [the BaSotho] see soil [...] and it was quite important to ask the locals [farmers] about their conditions (P8:2-3).

I was working with small scale farmers and understanding how they viewed their soil... because I saw very quickly in my training that the western notions of what a good soil is versus a bad soil didn’t translate into how traditional people managed and interacted with soils (P22:2).

This motivated P22(1) to question and research “[the] longstanding tropes of tropical soils that cannot yield civilization [...which] we’ve [now] debunked!”. P21(1) similarly highlighted that exposure to IK during field work inspired them to further the project of Africanisation:

I started with a lovely project [...] focused on the San [indigenous] knowledge, [...and], I realized that we have such a westernized curriculum that doesn’t always take the local context into consideration, especially in, you know, if you look at the towns that we work in, in the Northern Cape, the kids really struggle, I think, to understand scientific western concepts... whereas if you contextualize it in terms of local context, I think they will make much more sense of the curriculum... so the whole idea of really focusing on the Africanisation of the curriculum started there.

Thus, exposure to educational theory, or to IKS contexts and practice, were found to be key catalysts to forwarding participants deeper inquiry into transformation and Africanisation of curricula. In this regard, some participants voluntarily engaged with further studies (P2:1; P5:1; P25:2), while others were engaged by the university’s professional training programmes (P8:13; P9:13; P11:15; P13:1). The literature concurs in arguing for both theoretical and

practical pedagogic training being important in developing professional academics (Leibowitz *et al.*, 2017; Padayachee *et al.*, 2018). Nonetheless, Behari-Leak *et al.* (2018) contend that traditional academic development programmes are being critiqued to ensure that they remain relevant to present-day transformation imperatives in South Africa, and equip academics accordingly. Furthermore, Clarence and McKenna (2017) argue that academic development should also specifically aim to educate lecturers about the socially situated nature of knowledge construction within specific academic disciplines: including how knowledge is built, critiqued, and how it reflects particular values and practices.

Some academics also experienced alienation in their education, often sensitising them to their (future) students' struggles with epistemic alienation. The preceding quote (P21:1) touches on the recognition of a 'disconnect' between existing western science curricula and students' lived experience and knowledges. This disconnect is termed as 'alienation' from the curriculum in the literature (Loo & Rolison, 1986; Lave & Wenger, 1991; Cobern & Aikenhead, 1997; Mann, 2001; Sennett *et al.*, 2003; Davids, 2019; Blackie, 2019; Dison *et al.*, 2019; Adonis & Silind, 2021; Apple *et al.*, 2022). P11(1), P14(1), and P15(2) shared their personal experiences of alienation from the western curriculum. P14 for example was raised in a household where IK was the norm. Their formal schooling however dismissed such knowledge in favour of 'superior' western knowledge. This conflict and uncertainty resulted in their disconnection from their IK epistemic roots: "[my elder siblings] were beginning to despise [(IK)] [...and when I started] school, then my teacher would tell me [science is] the right knowledge [...] but when I was at home, I would face a different knowledge system, so that kind of really confused me" (P14:1). Only in their postgraduate studies did P14 come to reclaim their own epistemic agency, and reconnect with their valuing of IK. P11(1)'s experience also exemplifies how the 'universalising superiority' of western science resulted in their alienation as an undergraduate student:

[The lecturer] was talking about Charles Darwin and he said something to the effect of if you don't know about Charles Darwin, what on earth are you doing in this class... now, we've never learned about evolution at school before and so immediately I felt a little bit isolated, and [...] not quite in the right space I suppose, not the right fit, not the right field, [...] there was always the sense of... is this really the space for me? And I mean eventually I ended up in education so that's telling you something I guess (laughs).

Importantly, in overcoming this alienation, P11's personal journey led them to becoming an academic and pedagogue – thus reclaiming their epistemic agency. Thus, in a process of

overcoming limitations, P11 exemplifies a personal and professional journey toward discovering transformative teaching practices.

For others, their personal engagement with Africanisation and curriculum transformation hinged on being externally sensitive to student alienation and the consequent epistemic disconnect. For example, P4(11,12) highlighted that for them it required facing the personal discomfort of this disconnect, and then due to personally valuing caring inclusion, deciding to strive to connect to students. P12(1) was similarly frustrated to noticed that transformation theory did not become pedagogic practice, and that systemic inequalities remained in the classroom and university. P2(4) spoke to this as a desire to improve their pedagogic offering and a means to connect with students, and offer them meaning in the process of learning. P17(1) sought to transform this unequal classroom power dynamic, driven by a desire to empower students. These personal routes to deeper understandings of students' alienation from the curriculum, fuelled these respondents' journey to research and practice (African) student-centred teaching. Respondents thus moved from recognising this disconnect, to a desire to connect with students, to taking steps to transform their curricula by way of Africanising theory and praxis with their students – and in this process finding personal meaning and satisfaction (P2:25; P4:11; P13:2; P15:2; P17:1; P21:1; P26:7).

It emerged from the data that an integral driver to the development of this personal academic journey was the practice of reflexivity. The subsequent section accordingly discusses the emergence of the code: *Reflection: Questioning Deeply*.

7.3.2.2 Reflection: Questioning Deeply

Reflexivity in transformation research can be broadly defined as critically reflecting on how teaching may be shaped by one's personal experiences, including beliefs, values, and political ideologies. This practice can serve as a powerful tool for exploring and transcending assumptions, biases, and value judgments – thus advancing transformation and Africanisation (Waghid, 2002; Maunganidze, 2016). Reflexivity is often proposed as a route for those wishing to critically examine their worldview within science education, so as to avoid perpetuating problematic euro-centric epistemics (Higgins, 2014).

Furthermore, Benvenuti *et al.* (2022:93) specifically argued “[a] key mechanism for addressing the discomfort and transitioning across threshold concepts and bottlenecks is reflexivity”. To apprehend the complexity of systemic inequalities, academics can engage with pedagogic, decolonial, and Africanising theory (and their attendant threshold concepts). In the context of an expanded understanding of such theories, they may then reflect on their own epistemic assumptions, thus driving epistemic transformation both within themselves and their curricula (Meyer & Land, 2003; Hayes *et al.*, 2021). There is however a recursive complexity to processes of reflection; P13(10) acknowledged this by paraphrasing Adam Habib, the former Vice Chancellor of Wits: “transformation, it’s messy, and the question is do we know transformation when we see it? Or do we see transformation when we know it?”

Participant P2(22-25) echoed this by highlighting that the process of reflection is a cyclical critical questioning of one’s own paradigms, which progressively shift one’s pedagogic practices. In turn, P24(1) framed it that reflecting on their own biases increased their empathy for others (differing yet valid) lived experiences, and engendered in them a more accommodating attitude. P1(1) and P3(9,10) both spoke of the need to reflect so as to allow one to apprehend the disconnect between students and academics and thereby realise the need for change. P3(9) and P18(1) added that this critical questioning should also directly interrogate the curriculum. It was argued that this required empathy and contextual and relational sensitivity in the classroom, to produce a “fit for purpose” curriculum (P13:2) (see linkage to *Fit for Purpose and Learning Context*). Importantly, P17(2) highlighted that such personal reflexivity connects a person’s inner and outer worlds. And went on to explain that this is a systemic issue, as the western education paradigm lacks an inner component, and is rather focused on external results/products:

much of that [reflective] work is about unravelling...our internalized oppression, our internalized view that we see things differently and that our view maybe isn’t as good as the dominant narrative... [...] but that sense of how the outer world and the inner world is so related that we need to unravel the inner world in order to change the outer world... and [...] the way the dominant education form has been kind of globalized is not about turning inwards... so yeah, there’s a lot of pressure for the external... for the materialistic rather than that sense of what is your calling or *obizo*, to use the Zulu term, or your *svadharma* [Hindu term], you know, what is your unique offering to the world?

While reflexivity is important in refining one's own thoughts, it is the introduction to a threshold concept expands the scope of what one can reflect upon. Upon reflection, threshold concepts can serve as important markers of 'step-changes', and the moving beyond previous conceptual limitations, within the development of one's thinking. (Meyer & Land, 2003). Thus, in an academic embracing uncertainty and the unknown (i.e. having a student mind-set), they open up to learning from diverse epistemics (and unlearn old limiting perspectives) (P4:16; P12:17; P15:6,25; P21:7).

Importantly, Forrest (2008) maintains that critical reflection enables one to question the 'accepted wisdom' of a discipline's canon. Deeply questioning the established body of knowledge within a discipline (the canon) can expose its biases (Le Grange, 2018; Sebola and Mogoboya, 2020). Participants suggested reflecting upon what knowledges are included and which are excluded (P12:16), the origins of the canon (P15:24), and the values embedded in the discipline (P15:9). Such 'troubling of the canon' can start to uncover inherent epistemic power imbalances in a discipline, such as: whose knowledges are privileged and whose are marginalised? From whose perspective is the historiography of the discipline written? What ends do the values of the canon represent? Thus, deep reflection upon epistemic and pedagogic theory, can broaden perspectives such as to prompt re-evaluation of beliefs held about the presumed certainty of the foundations upon which (western scientific) knowledge is constructed, and who's knowledge is privileged in the construction (P4:13; P13:4; P12:17). In such deep questioning, transformation can be advanced by 'bringing to light' limitations (or biases) of a discipline (see linkage to *Status Quo: Tensions and Limitations* and *Transformation as Process: Beyond Examples*).

Such reflection on the (often unquestioned) epistemic status quo of a discipline, can productively open up 'epistemic space' for meaningful and productive dialogue with other knowledges, and thus forward the Africanisation of curricula (see linkages to *Dialogue and Connection* and *Valuing Plurality and Indigenous Knowledges*). Similarly, reflecting on meaningful encounters with a diversity of knowledges within a local context (e.g. classroom, or field), can embolden one to explore beyond the accepted 'superiority' of a western-science epistemic (P12:13). This subsequently enables reflection on the similarities and differences between western and IKS, such that a more inclusive and equitable approach to knowledge

creation can be promoted (P10:7; P21:3). In turn, the inherent incompleteness of knowledge means the outcomes of these approaches are inherently uncertain. Embracing this uncertainty allows the human knowledge-creation project to move beyond simplistic ‘right’ and ‘wrong’ categories, towards more synergistic and pluralistic understandings (P15:24,25; P24:6).

Additionally, reflecting upon one’s teaching experiences and shortcomings in an African university context, can bring one to strive to transform curricula to better meet students (P4:1). Such limitations can provide opportunities to choose to reflect; thus prompting academics to critically examine assumptions underlying their discipline and their teaching. Consequently, they may feel compelled to adapt their practices to effectively meet the needs of their specific learning environment (P15:21; P24:5). Critiques that were forthcoming from participants’ own reflections from within an African university, included that: assessment is congruent with rote learning, not critical thinking (P12:16); academics should be facilitators of learning, not lecturers of knowledge (P15:21); education is problematically commodified as a product in the global South (P23:2); the university mirrors capitalism in its extractivist accumulation of powerful knowledge (P12:16); universalising scientific knowledge has failed in its explanations and solutions (P15:23); for new knowledge generation, the university must push beyond a monolithic western worldview, and Africanise (P15:9); meaningful transformation requires intensive self (internal) and curriculum development (external) (P21:13). These probing critiques demonstrate the role of self-reflection and questioning norms, both at the individual and institutional levels. From such insights, renewed action becomes a possibility, to move transformation forward. P24(5) concluded that “you need to be [both] critical and open minded and [...] you need to continually experience and reflect in order to improve the changes that you envision.”

Thus, while reflection assists individuals in unearthing their hitherto unexamined conceptual limitations, so as to move beyond them, it also emerged from the research that a ‘moral aim’ could inspire academics to *want to* reflect (P12:1; P15:25; P23:1). In the case of Africanising curricula, a driver which emerged, was the aim of education constituting restorative social justice within South Africa.

7.3.3 Vision(s) of Africanising Curricula

Many academics, including scientists, have identified the totalitarian euro-centric worldview which underpins science disciplines as epistemically inequitable (see Chapter 2). Recognition of the consequent limitations within African university science curricula can lead academics to engage in a personal and professional transformation journey. This journey is a progressive move toward valuing a diversity of epistemics – in an Africanisation process that is contextually responsive. This process is inspired by a desire for contextually socially just change, and visions of what that may mean. This section accordingly discusses the emergent codes which comprise *Vision(s) of Africanising Curricula*. These include the desire for epistemic justice, and the multiple interrelated, transformative and progressive visions of Africanisation that it can engender.

7.3.3.1 Social Justice Aims

While ‘social justice as the aim of tertiary education’ emerged as a focused code (Level 2) from only three interviews, it did occur across categories of participants (viz. curriculum only; curriculum and IKS; soil only). Importantly, it distinguished itself as a theme by explicitly visioning a far-reaching aim of a transformed university in (South) Africa. That is to say, a vision in which higher education’s purpose is that of a socially just public good for all South Africans. Further motivation for this is strongly supported by the literature (see Chapter 2).

Through participants’ personal journey, they became aware of the failures of tertiary education, *inter alia*: epistemic access, assimilationist model, differing values and logics, unequal power relations, curriculum biases, siloed knowledge (see linkage to *Status Quo: Tensions and Limitations*). This awareness of epistemic injustices kindled in them a desire to offer meaningful education in the difficulties of this South African context (P4:1,2; P6:4; P26:27). P6(4) suggested raising awareness of these issues by actively interrogating systemic assumptions and biases within the curriculum:

[Those] very underlying structures are things that people don’t necessarily see or think about, but when students from a different [...] cultural background, step into intuitions, the institution can completely, sort of walk over that cultural background and there’s a mismatch between, [...] ways of knowing the world and ways [...] of being in the world that can have very detrimental effects on people who don’t come from the background that the university assumes they come from.

For these participants, meaning (for both students and academics) could be achieved by directing education toward social justice aims (P26:27). P6(4) suggested that the path toward realizing such an aim prioritizes empathy and kindness. While P26(27) suggested that valuing teaching and the empowerment of students could forward social justice aims. P23(22) contended that social justice comprised facets such as: the epistemic justice of contextual relevance, environmental justice and sustainability considerations, and respect for students and their knowledges. Other participants intimated that social justice in teaching included imparting meaningful professional skills, embedding critical thinking and problem solving, inspiring a desire to learn and seek purpose, fostering students' epistemic confidence and agency, enacting mutual respect for diversity, inclusion of African values, and cultivating participatory approaches (P10:1; P13:12; P14:8; P11:14; P15:28; P17:2; P21:11; P24:1)

Social justice is a broad term which entails the promotion of social good toward previously marginalised groups. It thus includes considerations of fairness, distribution, recognition, access, voice, agency – and includes structural, cultural and material conditions which extend societal benefits to its people (Singh, 2011). In an extremely inequitable society such as South Africa, such redistributive justice should also extend to education and knowledge production (StatsSA, 2019). Waghid *et al.* (2023:88) support this argument in the context of South African higher education, stating that:

transformation [should] inherently assume cornerstones of social justice: with concepts such as redistribution, equity, recognition, power, representations and voice being central tenets. Teaching and learning as acts of transformation aspire to encourage social justice within the higher education space.

Similar positions – on the centrality of social justice as an aim of the transformative Africanisation of curricula – are held by various authors in the literature (Cloete & Moja, 2005; Postma, 2016; Hölscher & Bozalek, 2020; Meyiwa & Cekiso, 2020; CHE, 2022; Heleta, 2023; Manthalu, 2023; Omodan, 2024). For example, Adonis and Silind (2021:86) contend that, “knowledge should not be produced for the mere sake of knowledge production but should instead be dedicated to the pursuit and attainment of social justice through social action”. In turn, Tomlinson-Clarke and Clarke (2016) argue that such transformed learning empowers students' epistemic agency to advance changes in society, toward socially just ends.

Then again, the conclusion that worldviews can be problematically oppressed by science's universalising narrative is not always easily understood by scientists. This can be due to coming from the positional privilege of the dominating epistemic, which does not require accommodation to other worldviews. Moreover, science's marginalisation of indigenous and student knowledges means that alternative epistemics are more difficult to see, hear, and appreciate as valuable (de Sousa Santos *et al.*, 2008; Ndofirepi & Cross, 2017; Angu, 2018; Patin *et al.*, 2021; Belluigi, 2023; Irzik & Kurtulmuş, 2024). This is comparable to (and intersectional with) the privileged position of power that maleness and whiteness hold, which has similarly been critiqued by feminist and critical race theories respectively (Haraway, 1988; Nathane, 2019; Belluigi & Thondhlana, 2020; Neto & de Lima, 2020; Reyes-Sánchez & Irazoque, 2022; Adeyemo & Sehoole, 2022; Omodan, 2024). This is accordingly critiqued by Blackie (2024:10) "[t]here certainly is a need to ensure that the classic image of the scientist as a white, heterosexual, cisgendered male no longer prevails. There is also a need to disrupt the notion that science is a body of work produced by dead Europeans" (see Chapters 2 and 4, and linkage to *Hindrances to Africanising Curricula*). Consequently, foregrounding diverse epistemics, centred in the locale, has been suggested as a socially just 'antidote' to the epistemicide of other knowledges by science in the university. For example, Fataar and Subreenduth (2015:15) posit an ecology of knowledges approach which:

demands co-presence and incompleteness, inter-subjective dialogue, thinking beyond the western canonical line, and an incorporation of the knowledges of the subjugated, the repressed, and those knowledges that have been discursively marginalized.

While similarly, Mbembe's (2016) proposed pluriversity is:

not merely the extension throughout the world of a euro-centric model presumed to be universal and now being reproduced almost everywhere thanks to commercial internationalism. By pluriversity, many understand a process of knowledge production that is open to epistemic diversity. [...It] embraces it via a horizontal strategy of openness to dialogue among different epistemic traditions.

These are thus 'visions' of a transformed (South) African university. The chapter accordingly turns to the interrelated codes which arose as vision(s) of Africanised university soil science curricula in Africa, namely: *Valuing Plurality and Indigenous Knowledges*; *Dialogue and Connection*; *Fit for Purpose and Learning Context*; and *Transformation as Process: Beyond Examples*.

7.3.3.2 Valuing Plurality and Indigenous Knowledges

This theme emerged from 17 of the 26 participants, although almost entirely from those with IKS or curriculum transformation expertise. They argued that, for Africanisation to be advanced and curricula to be transformed, plurality needed to be valued. This centred on valuing local, indigenous and other epistemologies (P3:3,11; P4:5; P7:6; P12:10; P13:6; P18:5; P22:5; P23:2; P24:4); this included respecting multiple worldviews and diverse value sets, including those of students (P1:5; P20:8; P23:24). The code also encompassed developing capacity to hold conflicting worldviews (P2:8), and valuing: diverse identities (P4:5), intangible subjectivities (P13:6), multifaceted ontologies and the ‘more than human’ world (P17:11; P20:2), alternate pedagogies and interdisciplinarity (P15:13); as well as acknowledging multiple scales of transformation (P12:5). Participants also specifically argued that diversity of knowledge is valuable in its resilience and sustainability (P17:11; P20:9; P23:25). The value of epistemic plurality to humanity was argued by P12(10): “I obviously believe that knowledge is contextual, it’s historically bound, and so [...] the more deeply we know things in various ways can only enrich the larger knowledge project.” These and other aspects which constituted the code *Valuing Plurality and Indigenous Knowledges* will be discussed as the characteristics thereof, barriers thereto, and enablers and practices thereof.

Valuing Plurality and Indigenous Knowledges represents a commitment to acknowledging, respecting, and integrating diverse ways of knowing into Africanised curricula. This aims to move beyond a western mono-episteme, and embrace a more pluralistic outlook. The code is characterized by a fundamental respect for other views and values, regardless if people’s worldviews differ (P1:4; P2:5). In this regard, P3(16) opined that “[your own] knowledge create[s] your identity”; thus, in upholding social justice, respecting another also entails respecting their epistemology. This is underpinned by acknowledging that a diversity of perspectives is valuable, especially to learning (P1:10) (Etieyibo, 2016; Sigl *et al.*, 2023; Garrote, 2024). This signifies that student and local community knowledges are valued and integrated into curricula (P2:20; P3:11; P7:14). The literature similarly argues for the incorporation of indigenous and student knowledges in Africanising curricula (Le Grange, 2004; Asabere-Ameyaw *et al.*, 2012; Msila, 2014; de Beer & Petersen, 2016; Reddy *et al.*, 2017; Angu, 2018; Padayachee *et al.*, 2018; Naidoo, 2020; Khumalo, 2023). In this regard, Higgs (2016:96) specifically argues that:

the underpinning rationale of the curriculum in higher education in South Africa should be to convey to a diverse learner population the idea of the legitimacy of their own voices. Learners should be encouraged to look for the significant connection between content offered in the curriculum and their own life experiences. This poses an obvious challenge to educators in higher education to facilitate the connection between the content of the curriculum and life experiences.

It is thus a continual process to value new and diverse knowledges which one encounters (P1:15, P7:13, P13:17). This may necessitate unearthing and unlearning assumptions and biases toward ‘other’ knowledges (P1:5; P12:11).

Such a process is made possible by reflexivity and an openness to other epistemics, and is forwarded by engaging in dialogue between worldviews (P1:11; P2:5,19; P3:17; P7:13; P17:9; P24:3) (see linkage to *Dialogue and Connection*). P23(25) argued that a desire to learn and widen one’s worldview, underpinned such engagement. Lastly, P7(6) also advocated that, as an epistemic, IKS are generally more accommodating of multiple truths and realities; and thus academics should engage deeply with IK epistemologies to assist in *valuing plurality*. This can result in widened worldviews which *Value Plurality and Indigenous Knowledges* (P1:12). The synergy of different perspectives, as effected in the site of the curriculum, can thus begin to diversify the mono-episteme of the western canon of soil science (Stephens, 2000; Winiwarter & Blum, 2006; Aikenhead & Ogawa 2007; Friedrichsen *et al.*, 2022). Importantly, P12(5) highlighted that transformation itself was multifaceted, in that there was a need for it in a plurality of scales: the micro (curriculum), meso (institutional), and macro (national and global). Thus it can be seen that a commitment to *Valuing Plurality and Indigenous Knowledges* is crucial for fostering inclusivity, challenging epistemic hegemony, and promoting a more equitable, democratic and sustainable knowledge landscape in African universities.

However, embedded in the code were numerous further hindrances to *Valuing Plurality and Indigenous Knowledges*. For example, P4(5) rejected narrow identity politics which would “exclude people who are considered non-Africans”; but went further to articulate that this extended to rejecting any form of exclusion, including privilege. Other properties of the code which were barriers included: stereotypes and generalizations (P6:7; P13:17), essentializing knowledge (P6:8; P12:10), binary thinking (P17:15); tokenism (P3:12); inequality (P20:10); dismissing African science as “voodoo” (P3:2), epistemic extractivism (P7:21), disciplinary

compartmentalisation (P12:20; P15:13; P20:2), western science as universalising and superior (P4:2; P13:6; P21:5; P24:4), and epistemicide (P3:8; P17:8). Dei (2014:166) similarly identify detriments to plurality in the university space: “the hegemony of Western knowledge, cultural values, and languages at the expense of Indigenous knowledges [...] Furthermore, a skepticism towards African cultural norms, identities, and local languages [...and] the trend towards cultural homogenisation, curriculum homogenization, standardization, and loss of cultural identity.” In this regard, a practical field-work example of WSS’s narrow outlook, which overlooked the plurality of LSKs, was provided by P20(2):

I decided to go... to learn about soils and soil knowledge between these ethnic groups [...] I found out that, soils were not considered [by locals] as a biotic resource, but [that] it was a living being with a soul and the capacity of agency [...and] linked that with rituals now, the communication between soils and humans [...] but, at that time they [soil scientists] were more interested in understanding soil classifications... taxonomies... which I think it limits the understanding of other soil knowledge, [...] just thinking about if they could classify? How they classify? Which were the parameters of great criteria used? etc. etc. [exemplified what] modern soil science is nowadays [...] thinking more about classification, thinking less about the life of the soil, thinking less about what other components, other [pluralistic] criteria that are, much more interesting than classifying soils.

In these ways, western science suppresses plurality; when it is taken beyond a method of inquiry, and deemed as *the* ‘objective’ metaphysics of *everything, ever* (P12:11; P17:11). In resisting such epistemicide, P12(10) further argued that: “I also do believe [...] that powerful knowledge systems as universal are problematic, and should be deconstructed.” Nonetheless, in calling for such deconstruction, P1(10) and P24(3) warned that students’ protest responses could be problematically radicalised; rather, they deemed transformation experts better equipped to critically integrate plural epistemics in curricula development. The university thus holds a powerful position in validating knowledge – which till now has legitimated western epistemic in Africa (P12:11). Yet, for this very self-same reason, it is in a position to meaningfully transform, and become a leader in validating other epistemics (such as IKS), as valuable.

There are nevertheless various threats to IKS, such as the ‘urban loss’ of IK, while rural students tend to trust their IK and be more familiar with it (P7:12). P14(1) and P19(6) echoed this by adding that African academics, raised within IKS, may become estranged from their IK in their adherence to the domineering western epistemics of school and the university. To highlight the negative impacts of modernisation’s marginalisation of LSK, P26(3) shared the following field-work experience:

in Transkei, [...] they had this excellent cultivation system that they call *gelesha*, which was perfect for that area... and then when tractors were introduced... they could have been introduced correctly using the principles of *gelesha*, but they didn't because they could plough with tractors in different ways, and they messed up the whole principle and messed up one of the big things namely to store spring rain's water in the soil which there, is very important.

P26(3) went on to explain that traditionally, while the oxen were still well-fed and strong, these farmers ripped the soil after harvest (autumn). This prepared the soils for water infiltration of the first spring rains and maximized summer soil-water storage. The introduction of the convenience of tractors resulted in ploughing occurring only after the first spring rains. This increased compaction and run off, caused erosion, and reduced soil-water stores needed during the growing season and mid-summer dry spell (Denison & Wotshela, 2009; Laker & Nortje, 2019b). Moreover, P26(3) extended the example, in which a local farmer had integrated *gelesha* with western mechanised methods. After ripping with a tractor post-harvest, this farmer used oxen to rip the 'traffic pan' (soil compaction caused by tractors). P26's experience also usefully demonstrated that until they established a respectful dialogue with the local farmer, the other soil science researchers (working in the area for 3-4 years) were unaware of this farmer's integrated practice. This example demonstrates both the vulnerability and the effectiveness of traditional in-situ practices, and their potential for useful integration with western practices. It also illustrates how establishing meaningful dialogue with other knowledge systems beyond the university is important for the discipline of soil science and its curricula (see linkage to *Dialogue and Connection*).

From these examples it can be seen that, due to its differing perspectives, IKS are valuable in their own right as knowledge systems – although they should neither be romanticised (P1:8). IKS are embedded in a place and culture and are thus dynamic and multigenerational (P3:6; P23:4; P24:2; P26:26). Importantly, in Africa, IKS tend to be underpinned by the humanistic values of *ubuntu* (P1:8; P15:9; P18:6; P20:1; P23:10) (Le Grange, 2011; Mugumbate *et al.*, 2023; Patel *et al.*, 2024). Participants specifically argued that IK tend to be locally suited, low-impact, and sustainable, which is valuable in facing current ecological crises (P14:2; P20:9; P21:4; P23:14; P25:11). Furthering this point, P21(4) further argued that:

I think indigenous knowledge systems differ from western science [...which is] reductionistic, I think this [(IKS)] is a very holistic system, which also includes the metaphysical [...and] also encompasses a worldview, that emphasizes living in harmony with the environment and [...] there's a lot that [...] we from western

perspectives can learn from IKS... and one of them, I really think is the focus on living in harmony and equilibrium with the environment.

P23(10) added that the African philosophy of *ubuntu* values the connections and dialogues needed for Africanisation (see linkage to *Dialogue and Connections*). It was also argued that IKS have a scientific rigour of their own, as they are experiential and evidence-based (P3:10; P21:3). Similarly, P7(4,5) supported this assertion: “IKS is a product [of] relentless experimentation on the part of small holder farmers. [...] So the idea basically is to keep pace with [...] an ever changing environment.” In this regard, P23(4) stated that IKS are not simply historical and traditional, but contemporary and dynamic. P25(11) for example related their experience of sustainable low-impact farming stemming from the local knowledge of small-scale emerging farmers:

if you want to have very, very tasty fruit, go and buy it from the emerging growers [...] the knowledge they bring is how can you farm properly still without just chemical fertilizer or chemical waste of chemical pesticides [...] their knowledge is actually a highly important because we... for commercial growers in a lot of senses forgot how to farm with nature... [small-scale farmers] know how to compost, for instance, in orchards by making ditches between the rows and fill compost and all those biological materials in there and they have positive effects by growing [...] other] crops in between the rows of permanent crops [...] nowadays, commercial growers says we want kind of dirty orchards... and that comes from [small-scale farmers’ knowledges] ... the good guys are all there [in the trash lines] and they control the pests... we’ve been cleaning everything... and we are detriment [...] sometimes I think, to an extent, they are forced to think in different ways because they don’t have access to money... access to money for emerging farmers is a big problem... they don’t own the land... they don’t own it so they cannot borrow on the land.

Thus, because of their ‘difference’ in approach (for which IKS has often been marginalised by modern science), such cases exemplify the fundamental value of a plurality of knowledges in tackling modern situated problems.

Therefore, for the hybridization of IK and western science to be successful in generating locally adapted solutions to complex modern problems, IK needs to be deemed science’s epistemic equal (P1:9; P2:5; P3:8; P7:2; P19:4; P21:4). P19(6) elucidated this position by stating:

... the moment you respect a certain systems and a certain way of how other people do things outside your own world view [...] things become easier to collaborate and to engage, you know, if there is no respect then it becomes problematic, [...] so if people respect IKS within the African context, [...] then it will make it easier to start the conversations... to make it easier to engage at deeper levels in terms of the curriculum, [...] so things flow easier in that particular way, [...] and when] you’re not seeing your knowledge as superior to them, you actually respect [...]

what they do (laughs) [...] then you open yourself to wanting to learn, and for them to actually learn from your perspective as well.

However, as P7(20) and P26(27) respectively illustrated, LSKs can have different reasons and values from WSS:

the [local] farmers would not want to use the red soil, for example for the crops... and it was quite strange for me, why wouldn't they want to... when we [soil scientists] say, these are the best [(most productive)] soils, [...] and they were highlighting, no, we use the red soils for our rituals, I mean, sort of like a... as a graveyard, instead of using these other soils because they're highly degradable... so you could see [...] their reasons are different from our scientific reasoning.

[local] people have names for the soils, and they rate them according to their land use possibilities [...] and those suitability ratings are not always what we [soil scientists] would make the ratings, because we make them from the viewpoint that, okay, it's going to be tractors and [...] they make them from [the viewpoint...] they have to use animal traction.

Yet the reasoning of LSKs is culturally maintained and sustainably suited to that biophysical locale (P19:2; P21:4; P26:27). If such IK is ignored by WSS, soil extension advice can fail, as P7(20) continued to share their experience:

As policymakers, we would say, okay, these are priority soils... red soils, don't use them for this [(gravesites)], [...but] there was a lot of abandonment of land [...] people who didn't even want to use that particular piece of land [for crops] because of different reasons which they highlighted [(and were disregarded by WSS)], although it was scientifically correct to use those particular pieces of land.

The literature bears similar evidence of the disregard of LSKs leading to the failure of soil extension initiatives (Bargout & Raizada, 2013), and consequently strongly argues for participatory approaches to soil management projects with local communities (den Biggelaar, 1991; Agrawal, 1995; Hagmann *et al.*, 1996; Sillitoe, 1998b; Kauffman, 1999; Van Averbek, 2002; Ryder, 2003; Gowing *et al.*, 2004; Ogen, 2006; Buthelezi-Dube *et al.*, 2018; Bapfakurera & Nduwamungu, 2020; Manyevere *et al.*, 2020; Pérez-Rodríguez *et al.*, 2023).

Thus *a posteriori* epistemic equality is requisite in realising the benefits of *Valuing Plurality and Indigenous Knowledges* (see linkage to *Social Justice Aims*). For, if science's superiority is retained as a benchmark against which other epistemologies are validated – then the depth of pluralistic value which other knowledges hold, cannot be realised (P7:2; P20:10; P21:5; P23:5). P17(14) further argued that to advance valuing plurality, one should attempt “to bridge worlds, the science world [(intellectual/cerebral/rational)], and the felt world [(emotional/intuitive/affective)] and the sensual world [(physical/kinesthetic/embodied)].

Similarly Hill and West (2024:2) argue that “future-facing [higher education] will privilege, as one of its vital components, a focus on the affective domain [...] In particular, an embodied, emotional engagement with the production of knowledge and understanding through relational learning and assessment.” In this regard, de Beer and van Wyk (2019) argue that integrating IKS in curricula, specifically affords opportunities for engaged and embodied learning – which can promote learning experiences in the affective domain and thus increase deep learning. Numerous participants advocated dialogue between soil knowledges as being valuable to the discipline’s Africanisation (P7:2; P19:7; P22:3; P23:15; P25:11; P26:6). P7(21) concluded that integrating such understandings of LSK in classroom discussion, supported teaching and learning, as “[students] were quite interested [...] we had an extensive debate for this first time...[there] was just so much interest in that [LSK] because they could relate to what they see [(student’s experiential knowledge)]” (see linkage to *Dialogue and Connection*). Importantly, discussions of LSKs should more holistically consider the K–C–P complex of the IKS (Barrera-Bassols and Zinck, 2003; Sandor *et al.*, 2006; Toledo, 2022) (see linkage to *Transformation as Process: Beyond Examples*). In these and similar ways, an awareness of the value of IKS as a compeer epistemic can be promoted (P19:7). Cultivating an intellectual openness and humility can allow for a mind-set that enables genuine engagement with diverse ontologies and knowledge systems, so as to realise the benefits thereof. Thus, the university curriculum becomes an important site for advancing the Africanisation project as a whole.

In advocating it, participants highlighted enablers of and practices focused on *valuing plurality*. Student, and local and IKS, were centred as sources of plurality (P1:4; P3:3,11; P4:5; P7:6,14; P13:6; P16:12; P17:7; P23:4) (see linkages to *Dialogue and Connection*). Participants also argued for the formal inclusion of IK into curricula (P7:12; P9:24; P21:9; P22:3). P7(21) in particular argued for the promotion of local academic publishers to publish locally grounded textbooks. In the same vein, P26(25) further argued for the value of informational pamphlets detailing diverse LSKs:

If we talk about local farmer knowledge and learning from farmers, listening to farmers, it’s of course not only the traditional black farmers, but also your commercial white farmers [...In] the old days, this knowledge was always transferred by word of mouth, never written down [and now,] people don’t spend time to write a textbook because there’s no incentive [in South Africa]. [...The] Americans [...produce useful...] popular, semi-popular pamphlets [of LSKs, but in South Africa they are] not really written up because there’s no incentive for

anybody to the write it up [...] It's a huge loss of knowledge [...previously passed]
from generation to generation, you know.

In further supporting plurality, P2(20) added that teaching and learning communities usefully comprising many voices. Comparably, P15(13) raised the issue of increased diversity in academic staffing being a necessity. Furthermore, P3(16) stated that engaging in multidisciplinary, with co-researchers (P15:11) was also important. Humility, openness, and mutual accommodation, along with respect for, and engagement with, diverse knowledges were thus argued as factors which developed academics' coming to *Valuing Plurality and Indigenous Knowledges* (P7:13,16; P12:20; P17:7; P20:2; P23:2,20). In terms of valuing LSKs, P26(6) for example related that:

what I decided was to watch the farmers and first learn from them [...], you can't do research, you can't do extension or give advice, [...] and you can't teach your students [...] if you do not know the following three things: what do the farmers do? How do they do it? And why do they do it?

Consequently, the opportunity of the "lecturer as a learner" can be realised – where the academic is open to learning from others' epistemics (P17:9). This could be considered "cultural border crossing" on the part of the academic (P2:4). Usually, students' cultural border crossing is facilitated by academics – toward a culture of academic knowledge (Cobern & Aikenhead, 1997; Ogunniyi, 2004). Whereas in the process of *Valuing Plurality and Indigenous Knowledges*, a similar epistemic effort is asked of the academic in engaging with diverse knowledges. Dialogue between knowledge holders is therefore integral to the process of coming to value diverse epistemics. Accordingly, the chapter turns to the emergent code in this regard: *Dialogue and Connection*.

7.3.3.3 Dialogue and Connection

Connection through dialogue was a code that emerged from 20 of 26 participants. Participants indicated that there is a (mutual) knowledge 'gap' (or distance) between academics and their students. That is, students have not yet acquired disciplinary knowledge, and academics are unacquainted with the knowledge with which students arrive. For this gap to be bridged, such that meaningful curriculum transformation and attendant deep learning to occur, numerous participants argued the importance of fostering connection through dialogue (P3:14; P6:9,16; P15:18; P18:6; P19:6; P20:22; P23:18; P24:5). Seeking epistemic connections (commonalities) is important for effective teaching and learning, as it enables educators to ascertain students' existing knowledge, link to it, and subsequently support further learning (P3:15; P5:17; P6:16;

P8:28,31; P15:19; P18:6; P23:18) (see linkage to *Fit for Purpose and Learning Context*). Accordingly, fostering dialogue to increase the accessibility of knowledge, can affirm students' epistemic agency (P23:18; P26:9). In other words, they are respected to co-construct their own understandings and become active self-directed learners (P6:20; P19:6; P21:14; P26:9) (Amador, 2019). Seeking to build on existing student knowledge aligns with sound pedagogical theory and practice such as Vygotsky's zone of proximal development (Vygotsky, 1978; Vygotsky, 1986; McLeod, 2024). Moreover, engaging in dialogue shifts the pedagogic practice from transmission education to one that centres the student (P26:9), and academics may transform their role to one of knowledge facilitation (P6:20).

Dialogue as a means to establish epistemic connections was characterised by participants in numerous ways. Effectively, dialogue is a tool to seek out mutual understanding and accommodations between diverse epistemics (P3:17; P6:17; P8:29; P15:20; P19:2). In addition to student-academic dialogues, P15(18) highlighted the importance of fostering inter-student dialogues, so as to support peer co-construction of their own understandings of the disciplinary content (Johnson & Johnson, 2018; Amador, 2019; Simpson *et al.*, 2023). P20(22) highlighted the importance of dialogue adding social dimension which can also deepen learning (Wenger, 2010). While P25(8) indicated that dialogue between academics was another important route to seek ways to forward curriculum transformation (Bell, 1999). This includes seeking out inter-disciplinary dialogues between social and hard sciences (P6:16), as well as reflection (P6:11). Engaging in dialogue with knowledge holders beyond the university was also advocated; in particular, to build links between disciplinary knowledge and local contexts' LSKs (P6:9,16; P9:26; P10:10; P15:19; P18:6; P20:22; P23:18). P20(5) for example, provided an example of the importance of connection in indigenous African soil practices:

... among an ethnic group in Mali or Senegal, [...] they were dealing with soils according to their religion [they] connected the moral, ethical values, with the physical conditions of soils and how to proceed for maintaining soil behaviour and soil health and rituals... for example, [...] before you start doing your agricultural activities, you perform a ritual to ask the soil to behave... as a communion, as a relation between men and women... and then I found out that the same ritual is for the wedding [...] so it's an engagement, [...] it's a connection [...] so connection for me is the most important issue.

Mabeza's (2014) case study of a Zimbabwean smallhold farmer's IK for example, details how their worldview and resultant practices of a connected 'marriage' between soil and water, resulted in remarkable crop yields. P18(6) concluded that the inclusion of other voices (by way

of dialogue with local communities for example) is needful to advance the Africanisation transformation project:

I think they need to engage with external stakeholders... [...] unless we get other voices in and other input and it's going to be meeting upon meeting [...] and we're just going to keep getting more frustrated with ourselves [...so,] bringing in community members [...] might get us to think more innovatively about how we can bring the two worlds together instead of always being two worlds apart.

P10(10) advocated the value of engaging in dialogue with IK holders to discover parallels and develop synergies between different knowledges. While, in the university, P15(31) and P23(18) argued that inclusive dialogic approaches in enacting curricula allowed for bottom-up debate and knowledge creation. Simmonds (2020) supports this with the assertion that there is “a much needed (re)thinking of lived curriculum as complicated conversations [...Nonetheless, enabling such] curriculum transformation requires a shift in hegemonic conceptions of the subject and of knowledge.”

Thus, dialogue that seeks to connect students to a discipline is only possible when epistemic diversity is valued (P19:2). That is to say, true dialogue only occurs between epistemic equals (P3:14) (see linkage to *Valuing Plurality and Indigenous Knowledges*). While students may not be disciplinary experts, they do bring their own valuable knowledges, which should not be dismissed. This is because others' knowledge has both intrinsic values, and can also be connected to, to support learning (P23:18). Thus, initiating dialogue can open opportunities to elicit locally relevant examples from students, making abstract concepts more relatable and accessible, and which can assist in bridging the epistemic 'gap'. This is supported by Sotero *et al.* (2020:2) who argue:

aspects of local knowledge can be found in previous student knowledge, in multicultural curricula, and in the everyday practices of local communities [...] students and teachers have the opportunity to realize in practice how science and other forms of knowledge may connect and benefit each other.

Thus, a more dialogic educational environment values diversity, and thereby aims to empower students epistemically (P15:20; P26:9). Moreover, the possibility of diverse and located solutions is acknowledged. This honours, and usefully connects to, the African context in which learning takes place. The university curriculum is thus a valuable site for Africanisation. Explicitly acknowledging the importance of prior knowledge, and connecting to it to the curriculum, creates a more inclusive and engaging learning environment (P8:28). Yet, as Ryan and Deci (2020:9) contend, “despite how much we know about conditions that promote

engagement, motivation and authentic learning, policies that specifically aim to enhance the satisfaction of the basic psychological needs of teachers and students have not yet been widely adopted”. An absence of meaningful connection and dialogue can be deemed as a lack of epistemic respect (toward students), which can contribute to alienation, and ultimately, a less effective learning experience (P20:22) (Seehawer & Breidlid, 2021).

However, building rapport, fostering trust, and engaging in deep discussions can be time-intensive, a difficulty often exacerbated by the structural constraints of universities and the pressures of massification (P13:8) (de Sousa Santos, 2017; Le Grange, 2024). Lecturers can find themselves overwhelmed with administrative tasks and high teaching loads, such that designing and enacting more intensive curricula becomes untenable (P8:30) (Hemmings & Hill, 2009, Dlamini & Dlamini, 2024). Students are also unaccustomed to critical dialogues, as South African high schooling often relies on rote learning to meet matriculation targets (Chetty, 2015; Maddock & Maroun, 2018; Krause *et al.*, 2025). Material oppression also presents a significant barrier, as students from disadvantaged backgrounds may face additional challenges that limit their ability to fully participate in academic life (P15:20). These challenges can include financial constraints, lack of access to resources, and social and cultural barriers (Morrow, 2009). Moreover, such an approach may be particularly challenging for scientists whom are often enculturated into a positivist epistemic, which deems knowledge as universally factual and not socially mediated (Jarvis, 1998; Glattfelder, 2019). From their own experiences as a scientist interested in Africanisation, P13(7) expounded on this:

I also try to go beyond the classroom context... to understanding the context of where [...] the students are coming from... I devote a lot of my time, which I think, in the sciences, that's where we miss it... a lot of the scientists would say, no we are wasting our time, this is not our job to understand social issues... but I argue and say look, if you don't understand these social issues, it actually means that we might be addressing the wrong problems in the classroom, you know... often I've sat down with students, telling me their history, where they're coming from and then, it's like okay, this could be the issue that constrain [their understanding...and this] digging it's not easy, [...] but once you start understanding these complexities... and you might start to find ways of doing things differently... and these ways of doing things differently are not rewarded by [...] the current system [which] leans towards things that are measurable [...] but bringing this... what they call [...] the social garbage... into the classroom is messy, and no one likes it (laughs) [...] and that's where I see a conflict there... you know, why we want to Africanise? People are so hesitant to get into these issues...

Science can thus be seen to ‘shut down’ dialogue by essentialising and dictating ‘a singular true’ perspective (P13:7; P20:11). Rather, debates of multiple knowledges (students’ and LSKs) forward the Africanisation project (P10:10). Ignoring the foregoing barriers will anyhow impede the centring of African students through dialogue, undermine epistemic bridge-building, and hinder transformation (see linkages to *Status Quo: Tensions and Limitations*).

Consequently, a conscious personal effort is required to cultivate a culture of dialogue (P6:17; P8:28). This involves not only respecting diversity, but also actively seeking to understand different perspectives, and working to connect them to the discipline, so as to stimulate learning (P3:17; P5:17). As there can be tensions between diverse perspectives, a commitment from facilitators is necessitated to create safe spaces for epistemic dialogue and exploration (P8:28; P24:5). In this, students are facilitated to feel secure in sharing their perspectives and thereby begin engaging in critical thinking between plural epistemologies. Again, this necessitates a shift in pedagogical approaches, moving away from the traditional model which ‘dispenses’ information, to that of a dynamic educator who seeks to mediate diverse epistemologies and facilitates co-constructed learning (Freire, 1970; Blackie, 2022).

Grappling with epistemic discomfort can be expected, if the transformative value of such connective dialogue is to be realised. Arao and Clemens (2013) highlight that safe spaces should not be conflated with comfort; but rather, they allow for discomfort to be experienced in a safe context. Such discomfort arises from encountering diverse worldviews that may challenge one’s deeply held beliefs and assumptions. As worldviews often feel intensely personal, engaging in open dialogue can be emotionally and intellectually challenging for both students and academics (P6:9) (Redmond, 2010; Verran, 2013; Waghid *et al.*, 2023). Thus, developing the capacity to face this discomfort is a crucial skill in a postmodern age which is characterized by uncertainty and a plurality of epistemics (P11:13) (Stewart, 2003). Developing a resilience to epistemic discomfort shifts beyond a mono-epistemic and moves to acknowledge diverse perspectives as valid. In this manner, dialogue can open up the possibility of connected learning and diverse solutions – specifically wherein African epistemics are integrated in curricula. P6(10) for example indicated that there is a perception of:

there being some kind of binary [...] between what science does and what local people do. I think the starting point is to sort of engage people through the idea of multiplicity rather than framing things as the binary [where] hard science is pitted against these sort of, soft indigenous knowledges and I think the reality is that's not necessarily the case.

Rather, dialogue and forging connections between epistemics can synergise the unique strengths of different epistemologies, leading to more comprehensive and nuanced understandings. Thus, moving beyond the discomfort of binary oppositions can offer new approaches to navigating postmodern complexity (P6:10; P17:4; P19:2) (Waghid, 2014). P11(13) concludes that honest engagement with Africanisation demands: "feel[ing] more comfortable with that discomfort [...] imagine what the other possibilities [epistemics/perspectives] might be like, [...] and how you have to remain open and how you have to be willing to listen to other possibilities."

P13(7) indicated that one can only address local needs by knowing who students are and what they know. In this vein, P8(28) suggested that tasking students to write a brief 'life story essay' can provide valuable insights for an into students' backgrounds, experiences, and perspectives. This can assist educators to discern students' existing knowledge, facilitate connection, and thereby meet them 'where they are at', as P8(28) explained:

I had them write a [life story] essay at the beginning [of the module...] and the one lady [...], she was the person holding the [stop/go] sign and then she lost her job because the road was done building, then eventually she got this bursary. So she was like, five or six years older than I was at the time... and I keep this in mind the whole time when I taught, because you know, how do you meet her? And yeah, stuff like that, [...] this bursary was her way out of poverty and she must make it work. It's not like she can fail [...] so something like that kind of hit me... and yeah, I tried to meet her and the other students where they were.

Cultivating such epistemic humility is essential to the process of meaningful Africanisation. Humility allows academics to recognize the limitations of their own perspectives, and to appreciate the epistemic value that others bring (P8:29; P15:31, P23:19). In this manner they may move beyond perpetuating the domination of western epistemics (Kerr, 2014). Such a stance of epistemic humility, involves actively listening, practicing non-judgment, inclusivity, and being open to the possibility that one's own understanding may be incomplete (P11:12). Empathy in particular enables connection, as one comes to consider another's worldview while different, also holds validity (P8:27; P13:8). In fostering connected dialogue, participants also advocated the need for other associated qualities, heartfelt reflexivity (P6:11), curiosity and

openness (P12:20; P19:6; P21:16; P24:5), respect for the other (P15:9; P19:6; P20:5); a positive attitude and belief in students' capacity to learn (P13:14), and authenticity and sincerity (P14:9; P21:13). P12(20) and P20(9) further argued that such a stance was underpinned by a personal desire to centre students and transform curricula (see linkage to *Personal and Professional Journey and Transformation as Process: Beyond Examples*). P26(9) for example shared that: "other lecturers, those that [were] after the high ratings [...] told me... you do the wrong things [...] but to me, the most important was my students, and not what my NRF rating is". Similarly, P14(10) advocated a commitment to transformative action beyond policy 'requirements', but also argued for leadership buy-in as a necessity for sustainable Africanisation. Informal social connections, field trips, and feedback questionnaires can also contribute to a more dialogic learning environment P13(8). P11(12) concluded that an extensive curriculum can better support such approaches, as it takes time to incorporate diverse perspectives and make real-world connections. Accordingly, the chapter turns to the interrelated code which emerged: *Fit for Purpose and Learning Context*.

7.3.3.4 Fit for Purpose and Learning Context

A key argument in the literature envisions Africanised curricula as being tailored to a local context, so as to meet local needs. In this regard, Africanisation seeks to recentre African locales, and decentre the legacy of euro-centric curricula in the African university (wa Thiong'o, 2008; Heleta, 2016; Ajani, 2019). These considerations also emerged from 15 of the 26 participants across all specialities.

Soil scientists tended to provide very pragmatic answers, considering it 'common sense' to consult local land users about their soil knowledge (P8:24; P9:22; P26:27). P8(25) for example argued that it is "just common sense [rather than Africanisation,] as whoever's on [...] that land will know it better than anybody". P9(22) added that "I'm truly in support of Africanising the syllabus to suit the African scenario, but we should also be careful not to discard the principles [of WSS]". Soil scientists thus endorsed the use of local examples in their curricula, and also declaimed the lack of locally suited textbooks and extended courses (P8:31; P9:15; P22:9; P26:18). While in support of local contextualisation, soil scientists did seemingly overlook the specific epistemic justice motivation for integrating local knowledges into curricula. Those participants focused on transformation and IKS were however more explicitly

aware of the politics of knowledge equality (P1:6; P3:9; P10:5; P13:17; P21:8; P23:10). In this vein, P7(8) for example, argued that there is “danger [in] universalising the particular and particularising the universal”. While P13(4) contended that:

having had meetings, you know, formal and informal meetings with colleagues, and [...some...] are very naïve to these issues and they say, ah come on, as long as I teach, what is important for them is to get a degree... but my question is that what kind of degree? You know, you want a degree that's appealing, that is an experience [...] but if you just say oh well, what we did twenty years ago, this what we did, we should get on with it (laughs)... I think that that's missing the point in my view... and this is typical in the sciences... [...] everyone has this assumption that science is not subjective (laughs).

It can thus be seen that soil scientists tended to subscribe to a universalising positivist epistemic, while other participants had a broader epistemic view. This is congruent with the analysis of the soil science literature in Chapter 4. See also linkages to *Transformation as Local Examples* versus, *Transformation as Process: Beyond Examples*.

Nevertheless, a particular issue raised by soil scientists and coded as *Fit for Purpose and Learning Context*, was that soil science theory in the university curriculum rarely translates to professional world practice. P8(25) for example stated that “all the universities are disconnected [...] nobody teaches [...] how to do a foreign land capability assessment cause that's what you would do as a soil scientist in an environmental field [...] it's something you kind of learn on the job”. Similarly, the fitness of the curriculum was criticised by P26(12) in that: “everybody doesn't have to become a research soil scientist”. Moreover, due to massification and COVID-19, soil science practicals had been cancelled (P8:33). Thus, university curricula often inadequately prepare graduates for fieldwork, whereas such experience is essential (P8:26; P26:27) (Field, 2020). There is an apparent disconnect between the university's curricula and the professional practice of soil science (see linkage to *Status Quo: Tensions and Limitations*). Regardless, soil science graduates are more likely to be employed as extension officers, environmental consultants and managers, than as academic soil scientists (Havlin *et al.*, 2010; Rozanov & Wiese, 2018; DHA, 2023). Furthermore, graduate soil scientists are poorly equipped to value and integrate LSKs in the field. P22(12) for example relayed their experience:

I'll speak from my experience in the Amazon where, [...] plenty of [external] people came along and [said] *let's fix* nutrition on the floodplain [soils]... let's bring these vegetables that [local] women *should* be growing so they feed their families... and the instant that those aid workers left those crops would be

abandoned... I mean, they paid no attention to cultural context... how does it fit [...] often they were not even asked the question... [locals are] just seen as simpletons, who don't know anything [...] we also found is that where an introduction *fits* the *needs*, the *experience* [and] the *knowledge* of local people, it will stick... [for example] jute was introduced into the Amazon by Japanese farmers, [...its] completely not native [...but] it was a success... Why? Well because it fit into the local livelihood flow [...] because it grew at the time of year where you couldn't grow anything else, during the flood phase... [jute] filled a niche in a livelihood gap... and so it was adopted very quickly [...] local people are open to newness, but it needs to fit into their needs and their perspectives... and I mean, [...if] the extension agent spends even just some modicum of time and attention and *really listens* to what people already know and do and what their actual needs are, then the intervention can be targeted and can be *successful*, by all measure[s:]... the external measure of the development person, but also the local people who actually find use for [...] the intervention [...this requires], a sensitization to *ethnography* to the *value* of traditional knowledge [...], and just a *respect* for people who are different from yourself.⁴²

This field-based example bears notable similarities to the process of meaningfully engaging with student knowledges and local contexts to ensure *Fit for Purpose and Learning Context*, as demonstrated by P26(2):

what I've seen in my [soil science] lectures is you can mention an interesting American example and the *students just go blank* [...] the moment you will say, okay, I've seen this here in this [South African] district here, and *they will light up* and you know, some would say yes, I've seen that on my father's farm or on my uncle's farm or something.⁴³

Thus, as previously argued, soil science curricula can alienate African students by adhering to monolithic western epistemics; and similarly, once so enculturated, graduates can perpetuate the imposition of unsustainable and contextually inept western interventions in local communities (see linkage to *Status Quo: Tensions and Limitations*). Participants contended that in tailoring a *Fit for Purpose and Learning Context* curriculum, stakeholders both within and beyond the university should be engaged (P2:18; P12:3; P20:18; P26:27). Therefore it is demonstrated here is that, valuing others' knowledge (students' or the local community's LSKs), makes for more successful knowledge sharing and integrations (see linkage to *Dialogue and Connection* and *Valuing Plurality and Indigenous Knowledges*).

In comparison to the epistemically siloed university, young graduates will certainly encounter diverse communities with their own LSKs. For these land users to accept and integrate the

⁴² Italic emphases added.

⁴³ Italic emphases added.

scientific advice offered, young soil scientists should respect existing LSK and seek meaningful synergies between the epistemics (WinklerPrins & Barrera-Bassol, 2004; Martínez-Villegas, 2007; Andersen, 2016; Teuber, 2022). Thus, to be *Fit for Purpose and Learning Context*, it follows that soil science curricula should be tailored to prepare students to encounter and respect African LSKs as inherently valuable. Accordingly, curricula should equip them with social science methodologies to be able to characterise an LSK, and consequently develop equitable and sustainable integration with scientific soil interventions (P22:13) (Friedrichsen *et al.*, 2022). The need for this is underscored by P7(3) who argued: “technology transfer without considering local knowledge systems, I think will come to not [*sic*]. I think it’s an exercise in futility really.” The participant (P7:17,18) concluded that soil problems are situated, hence solutions need to be suited to the local context; and similarly, curricula aiming to respond to African problems, should operate from an African perspective. P15(12) added to this, highlighting that the university should develop a sense of community (within and without), and align its vision with the locale – so as to ensure curricula are *fit for purpose and context*.

Thus, to advance development of a *Fit for Purpose and Context* Africanised soil science curriculum, academics can (P1:2,7; P2:18; P3:9; P7:3,7,18; P8:31; P9:22,27; P12,3; P13:3,11; P15:12, P20:18; P21:8; P22:12,13; P23:9; P26:27):

1. critically interrogate the contextual relevance of current curricula, and identify euro-centric mismatches;
2. ascertain the socio-cultural landscape and needs of the African context wherein the curriculum may be applied, and consequently include design elements in the curriculum to foster respect of socio-cultural contexts and aim to meet diverse land users’ needs;
3. apply a student-centred approach to scope the epistemic diversity of the student cohort, and establish respectful dialogue to include elements in the curriculum which interface with and build upon student knowledges.

In this manner the importance of an equality of knowledges is established in the curriculum; as in a postmodern milieu multidisciplinarity is an important route beyond siloed enlightenment epistemics (Friedrichsen *et al.*, 2022). Fostering such critical engagement with multiple epistemics (and valuing their diversity) is thus an important skill for curricula to foster. This aims to equip students to tackle the uncertainty of (contextually located) present-day poly-crisis (climate change, food security, biodiversity collapse etc.), which narrow positivist scientific approaches have both contributed to and struggled to address (Bjork-James *et al.*, 2022). P23(10) validated this by stating: “our planet is in a deep ecological crisis... so to enable the

survival, I much rather say planetary survival than sustainable development [...] we need other knowledge systems than the western knowledge system.” This hearkens to Albert Einstein’s famous quote: “we can not solve our problems with the same level of thinking that created them” (Bodinet, 2016:20). In this regard, by critically working to understand both different perspectives and similarities, P9(23) argued for a mutual accommodation of global scientific knowledge and local IKs, by:

highlight[ing] the limitations [...] of western soil knowledge] within our context, because I think it would be very wrong to just say, ah okay, because the farmers don’t want to use red soils in the African context, in their villages, then it’s [categorically] wrong to use agricultural red soils as agricultural soil... [because] then it becomes scientifically incorrect. So we can still say... right, scientifically, these [agricultural red soils] are the best, but within this [local] context because we have ABCD, we can adopt this [locally suited alternative]. [...] scientific and local soil knowledges] have to be complimentary and [...] we specifically highlight where they’re different and the reasons for that difference [to the students].

This is in agreement with the Africanisation literature which supports equitable and inclusive approaches to different epistemics (Waghid, 2002; Ogunniyi, 2004; Masemula, 2013). A transformed ‘*uni*-versity’ may thus develop into a ‘*pluri*-versity’, by being grounded in the epistemic diversity (students and community) of its local context – and thus become *fit for purpose and context* (Mbembe, 2016; Sebola & Mogoboya, 2020). Considering ontology and epistemology are inexorably linked, sensitised dialogic approaches regarding diversity – aiming to connect African ontology and a curricula’s epistemology. This may assuage student alienation and promote epistemic confidence and justice (Angu, 2018; Kim & Wilkinson, 2019; Knowles *et al.*, 2023). In this regard, P21(8) opined that by meaningfully contextualising curricula for diverse students, learning connected to the affective domain (social/emotional). This creates student buy-in, which cultivates self-directed learners and promotes deep learning – thereby resulting in increased epistemological access (de Beer & Mentz, 2019). P13(16) further argued that in the process of developing a *Fit for Purpose and Context* curriculum, an important appreciation of differences is fostered, and one discovers that they learn from diversity. By valuing such complexity, academics and students can develop valuable skills in holding and integrating differing perspectives (see linkage to *Valuing Plurality and Indigenous Knowledges*).

In this manner, an academic develops a perspective which values plurality, and consequently makes efforts to integrate student and IKs into their curriculum. Such approaches support Mbembe's (2016) vision of '*pluri-versity*' superseding the '*uni-versity*'. For such deep transformation to occur however, a commitment to Africanisation as an unfolding developmental process, beyond solely 'adding local examples' to curricula, is required. The chapter accordingly addresses the final focused code: *Transformation as Process: Beyond Examples*.

7.3.3.5. Transformation as Process: Beyond Examples

In the interstices between the forgoing focused codes comprising *Vision(s) of Africanising Curricula*, emerged another code which syncretised these codes, namely: *Transformation as Process: Beyond Examples*. The code emerged in 20 of 26 participant interviews. This code emerged as an acknowledgement that Africanisation of soil science curricula is a process that can only contribute to epistemic justice, if the transformation goes 'beyond examples'. That is to say, transformative Africanisation is about moving past superficial inclusions in curricula – of local soil names, for example. The code surfaces two important requisites for a deep and meaningful Africanisation of a soil science curriculum, namely: (1) such transformation is a process, and (2) it must go beyond solely including local examples. This section accordingly discussed the details of this focused code *Transformation as Process: Beyond Examples*.

Interestingly, while this code emerged across participant categories, soil science experts only acknowledged that Africanisation is a process – not that it extended beyond the addition of LSK examples. This is because they maintained that science itself cannot be transformed (P8:12; P9:18; P25:9; P26:29) (see linkage to *Hindrances to Africanising Curricula*). Furthermore, P21 expressed concern that some academics responded to the call to Africanise with the rebuttal: 'tell me what to do, and I'll do it'; P21(10) went on to problematize this response:

That's the easy argument because none of us have the answer. I mean, we're in this work to better understand how we can go about it [Africanisation...] So I don't think there's a magic formula [...Saying], bring me the formula and I'll do it [...] that's just killing the whole conversation.

Thus, reductive responses seek only additive Africanisation, rather than transformative epistemic justice (Ukpokodu, 2016; Ludwig & Boogaard, 2021; Sigl *et al.*, 2023). Christie (2008:156) also critiques this trend at a national policy level:

the South African government adopted conventional ways of thinking about education, the policy process and the nature of change. The education system it designed reflected ideas drawn from advanced western democracies rather than ideas designed to engage with actual conditions in [South African] schools and classrooms [and universities]. [...Thus,] the changes it achieved were additive rather than transformative.

Simply ‘adding African examples’ (e.g. local soil names) to the curriculum does not substantively transform the problematically domineering euro-centric scientific epistemic; nor does it counter, “the Westernized university [as] a machine of ‘epistemicide’” (Grosfoguel, 2016:30). Moreover, a narrow, superficial and mechanistic ‘tick-box’ approach circumvents the developmental process necessitated by the integration of diverse epistemics (P2:8; P11:19; P21:12; P23:6) (Schilmoeller *et al.*, 2018; Maistry, 2019; Leenen-Young *et al.*, 2021). Other participants also affirmed the conclusion that the Africanisation of curricula is a process and not an event; rather, it takes time and iterative development (P11:4; P13:12; P15:7; P18:8) (see linkage to *Africanising Curricula as a Journey*). Others added that all knowledge is incomplete, thus imperfect progress (i.e. learning) is preferable to not risking attempts in Africanising curricula (P11:20; P15:22,26; P23:8). Such understandings of transformation as an emergent process are useful because it highlights the need for a willingness to change, sustained effort, risked attempts, critical reflection, and an ongoing commitment to contextually informed, iterative and dynamic Africanisation.

Genuine Africanisation however further necessitates fundamental epistemic and structural shifts. That is if epistemic justice, in the context of the westernised university and curriculum in Africa, it to be targeted. Transformative Africanisation thus involves more than superficial inclusion of African LSKs, as mere illustrations within an existing western curriculum. This deeper transformation requires interrogating diverse facets of the curriculum while also comprising a substantial, process-based undertaking (P6:12; P11:4,11; P13:12; P15:7). P15(28) additionally argued for a shift toward process-based learning – for both students and facilitators (Hoadley, 2012; Johnson & Johnson, 2019). Participants highlighted that the transformation process includes exposing the ‘hidden curriculum of western epistemic biases’ in existing soil science curricula. Accordingly, participants advocated examining curricula from various

angles, including: pedagogic, political, structural, contextual, design principles, identity formation, inclusivity, cultural assumptions, societal norms, purpose, epistemic sources and hierarchies of power (P4:3; P6:8; P10:1; P11:3,7; P13:13) (see Chapters 3 and 4). The alternative worldviews and paradigms of LSKs can for example be respected and integrated into the curriculum, highlighting their sustainability and connected nature (P20:2) (Barrera-Bassols & Zinck, 2003) (Mabeza, 2014). Similarly, the ethical considerations raised by post-humanism regarding care and attentiveness toward soils, could meaningfully be integrated into curricula, in light of serious threats to soils (Krzywoszynska, 2019). In this regard, P6(13) argued that deep reflection on their curricula is required by academics:

if you're going to Africanise a curriculum, thinking about [...] how do [...] I, as somebody within that [disciplinary] system, how do I view knowledge? [...] what do I see as legitimate? What kind of research is being done? All of those very [...] hard questions [...] which academics are not often expected to do. And looking at how did that [discipline] get made? [...]and] in terms of the content, what do we select and why, [...] and what don't we select [and why?]. [...]Also,] in your designing that curriculum, or prescribing particular authors or particular ideas, [...] can you think through your own intellectual and social positioning [...]from] a decolonising perspective? [...]Additionally,] one of the most important questions in terms of content and curriculum is getting academics to ask of themselves, who are you designing your curriculum [for?].... because often we don't think about who our students are [...] what assumptions are you making about their backgrounds? About their language? About their schooling and about what kinds of knowledge are important within that? [...] then those are the kinds of ways in which we can start to do it [(Africanisation)].

Thus deep questioning of a soil science curricula is required for Africanisation to go beyond only asking 'what should be transformed?', to also asking 'what is the purpose of transformation?' (P11:3) (see linkage to *Reflection: Questioning Deeply*).

In the socio-historical context of South Africa 'transformation beyond examples', various participants argued that the moral purpose of a curriculum should be to prioritise epistemic and thus social justice (P4:1; P6:14; P12:1; P13:12; P14:5; P15:25; P23:22; P24:1; P26:13) (see linkage to *Social Justice Aims* and Chapter 2). This imperative for deeper curriculum transformation was rendered visible by the 2015/16 student protests (P6:8; P26:8) (Le Grange, 2016; Angu, 2018; Letsekha, 2022). P10(1) and P24(2) underscored that the curriculum is a political tool, in that it disseminates (or perpetuates) established societal norms – which the protests challenged vehemently. In the wake of colonialism and apartheid (in which positivism played a role, see Chapters 2 and 4), such 'politics of knowledge' cannot be overlooked in the

development of a socially just South African society (P6:8; P15:18; P19:3). Such an imperative asks for an anti-racist humanising and relational pedagogy which is contextually meaningful and values reflexivity and critical thinking (P10:1; P11:3; P13:13; P14:8; P15:8) (see linkage to *Dialogue and Connection* and *Fit for Purpose and Learning Context*). P14(6,14) contended that African terminologies should be developed in disciplines, as language is the vehicle of an epistemic; and that this should be done in dialogue with community LSK holders. P15(19) was specific in defining transformation as a elevating diverse worldviews for epistemic equality, and that beyond additive examples, there were a diversity of routes toward such an aim (see linkage to *Valuing Plurality and Indigenous Knowledges*). Thus countering the epistemicide of science's mono-episteme involves a fundamental shift towards pluralism or a 'pluriversity', in which curricula include diverse knowledges as equally valid (P4:4; P6:9; P12:17; P17:2; P21:12) (Mbembe, 2016).

It was accordingly highlighted that epistemic justice would not be served by essentialising knowledge systems and substituting one epistemic for another – but rather by acknowledging and integrating a plurality of epistemics in the curriculum (P4:4; P6:8; P15:8; P23:6). Correspondingly, it is a false dichotomy to disparage science of favour of romanticised IKS; or to elevate science as universal and denigrate the value of IKS (P17:2) (Toledo, 2022). Moreover, in upholding the equality of epistemics in the curriculum, neither should LSKs be benchmarked against western science as the 'standard' (P11:8) (WinklerPrins & Barrera-Bassol, 2004). In this regard, Häberli *et al.* (2001:7) argue that “[t]hrough mutual learning, the knowledge of all participants is enhanced, including local knowledge, [and] scientific knowledge. [...] The sum of this knowledge will be greater than the knowledge of any single [knowledge holder]”. Unfortunately, these kinds of approaches which value plurality can be antithetical to a universalising scientific mind-set (P12:19; P17:2). P21(10) did nonetheless contend that the scientific method is fundamentally open and curious; but that this openness has been overridden the in defending of its positional epistemic power, resulting in dismissal of other knowledge systems. Importantly, present-day poly-crises need hybridized and participatory approaches for sustainable locally-grounded solutions (P6:9) (Le Grange, 2024). Such understandings push Africanisation of curricula beyond additive examples, as these synergies necessitate inclusion of and dialogue between diverse epistemics, including student voices and community LSKs, and engaging in vigorous discourse and debate (P11:6; P14:7; P19:3; P23:13,25) (see linkage to *Connection and Dialogue*). Such meaningful inclusion can

transcend the ‘lip-service’ of including LSKs as solely examples (P14:7; P23:3). Thus, Africanisation beyond examples requires of academics: a willing epistemic openness, accepting uncertainty, experimentation, dialogue, connection, humility, and a respect for diversity (P11:7; P12:18; P17:2; P18:8; P23:8,13).

Locally grounded examples are nevertheless valuable initiators of connection, dialogue, and eliciting worldviews from students. Such relevant examples should seek to connect to students’ lived experiences, their local contexts, and their existing knowledge (P10:11; P11:5; P13:3; P15:27; P19:1; P21:2; P24:1; P25:10) (see linkage to *Dialogue and Connection*). The transformative aim of local examples can then transcend tokenistic additions – in a process which seeks overcome disconnect of abstract theory (which students can perceive as alienating or irrelevant), and thus foster deep and active learning (P13:3). P15(28) suggested that student reflective writing exercises and project-based learning activities are suited to such exploration and engagement of student knowledges, such that local examples can effectively be employed to connect to and arouse their interest to learn. P21(3) similarly argued that including IK or cultural artefacts and problem-based activities can prompt multi-modal deep learning. The literature terms this embodied, situated, and distributed cognition (Reddy *et al.*, 2017; de Beer & Kriek, 2021). Chahine (2013) defines this learning framework which incorporates engagement with IKS as being “physiologically embodied, socioculturally situated, and [...] distributed among individuals.” This resonates with P26(22) explaining that in their teaching with local examples, students, seeing their knowledge reflected in the curriculum were inspired and engaged: “you give a very simple local example and they’re all wide awake... and immediately that principle that you’re trying to teach them, they now understand... and they will remember it...because it’s a local thing... it’s something that they can associate themselves with”. In turn, this underscores the importance of student agency, buy-in, and active co-participation in the Africanisation of curricula (P11:17; P14:11; P15:12; P20:13; P24:1).

Students’ epistemic agency can be fostered by prioritising critical thinking, as this can empower them to value a diversity of knowledges, including their own situated epistemology and ontology. This allows them to connect with their local context rather than marginalising their worldview in favour of a universalising western epistemic. This is a just social and epistemic outcome of teaching. Accordingly, a range of other supportive pedagogic practices

were also suggested by participants as facilitating critical thinking and active learning; and consequently, transformation beyond additive examples. Examples included: epistemic scaffolding, tailored feedback, open book assessments, social learning and community engagement, alignment of learning outcomes, low-stakes formative assessments, authentic practical in-situ assessments and project-based learning (P8:12; P11:9; P15:28; P22:6,7). P17(10) and P24(1) further argued for teaching and learning to be transformed, it needed to be stretched beyond solely the cognitive domain; and rather also operate in the affective domain of feelings, attitudes and emotions – to solicit and connect with deep learning experiences (Hill & West, 2024). P21(3) had found success implementing STEAM (Science, Technology, Engineering, Arts, Mathematics) pedagogic approaches: “in the natural sciences [...] our training with teachers is to show them how you can use puppetry as a pedagogy... I believe in a pedagogy of play”. P21(11) did also add that it had been a long journey of knowing their discipline and learning educational skills for them to affect such epistemological border crossing (see linkage to *Personal and Academic Journey*). Thus Africanising curricula for epistemic justice necessarily goes beyond additive examples. Consequently, it involves structural transformation of curricula and the university in Africa. Crucially, this is in conjunction with a personal epistemic journey beyond a discipline’s canonical bounds.

There are obvious barriers to the deep transformation being proposed. Participants enumerated personal, cultural, epistemic and systemic barriers, such as: resistance to change and defensiveness of the epistemic status quo which affords privilege and power (P15:10; P23:8); high workload, limited teaching capacity, and throughput constrains (P8:12; P11:10; P15:32; P24:7; P26:13); pedagogically skilled academics (P21:11; P24:8; P26:29); entrenched student rote learning (P11:9); racial trust issues (P19:7); lack of institutional support for extensive curricula (P23:8; P24:8); university structures which limit epistemic justice and pedagogic creativity (P15:22; P23:17); and a low buy-in to Africanisation at all scales, not just the micro-curriculum (P11:17; P12:24; P14:6) (see linkage to *Hindrances to Africanising Curricula*). However, if accepted, such barriers endorse ‘tick-box’ solutions to Africanisation of curricula which deem additive examples sufficient to the transformation project – but neglect the epistemic justice imperative in the African university.

Rather, the proposed visions of meaningfully advancing the Africanisation of a soil science curriculum, can be understood as requisitely emergent (process-based) transformation that go beyond additive examples (P14:7; P15:7; P23:3,21). Thus, the process of Africanising a soil science curriculum can beneficially be advanced by the following guiding tenets:

- aim for epistemic justice (Section 6.3.3.1),
- which is advanced by valuing plurality and other epistemics (Section 6.3.3.2),
- so as to establish a connection and meaningful dialogue with students and IKS holders (Section 6.3.3.3),
- such that in turn, the curriculum can be adapted to students and the African locale (Section 6.3.3.4),
- and thus deliver on the aims of social justice by going beyond additive examples (Section 6.3.3.5).

7.4 Conclusion

This chapter has presented the focused and theoretical codes produced by the CGT analysis of expert interviews. In particular, the formation and details of these codes have been discussed, as per their grounding in the data, and in light of existing literature. Moreover, the linkages between codes, indicating their integrated relationships, have been indicated. These codes comprise the guiding tenets for Africanising a soil science curriculum, as proposed by this study. The next chapter accordingly presents the theoretical synthesis of these tenets and the consequent development of a CGT for advancing the Africanisation of a soil science curriculum.

CHAPTER 8: A CONSTRUCTIVIST GROUNDED THEORY OF A (SOUTH) AFRICANISED SOIL SCIENCE CURRICULUM-TRANSFORMATION PROCESS

8.1 Conceptual Building-Blocks in the Development of a Constructivist Grounded Theory

The ultimate CGT produced by this research, included various iterations of theory development which culminated in the final conceptualisation. This process comprised a progressive process of reflection on focused and theoretical codes, memoing, and existing literature. This section accordingly presents these salient and useful (in their own right) concepts and theoretical ‘building-blocks’, which contributed to the final theory produced.

In presenting the CGT, it should also be noted that, as Timonen et al (2018) argue, grounded theory studies result in a conceptual framework that offers greater conceptual clarity and which can deepen theoretical insights, rather than a singular ‘universalising’ theory. This resonates with the epistemological recommendations of this research, which has argued for the value of welcoming a plurality of viewpoints and approaches. Furthermore, Urquhart (2013:213) indicates that “[t]heories, by definition, have relationships between the constructs. The easiest way to depict relationships is with a diagram.” Accordingly, the theoretical building-blocks and the synthesising CGT, are diagrammatically represented and explained in the subsequent sections.

8.1.1 Micro Action-Reflection Dialogues: A Driver of Macro and Meso Research Cycles

An early conceptual building-block was produced by reflecting upon the praxis of developing and teaching an undergraduate soil science curriculum (see Chapter 6 for details). The theoretical model produced – micro action-reflection dialogues – became integrated into the development of this research project. This model illustrated, through micro-, meso-, and macro-scale iterations – of action and reflection – how an initial Africanised curriculum was developed and enacted, and learnings for improvement advanced and published. Important were the micro action-reflection dialogues, at the interpersonal level, which advanced larger scales of meso and macro action and reflection cycles (see Figure 8.1).

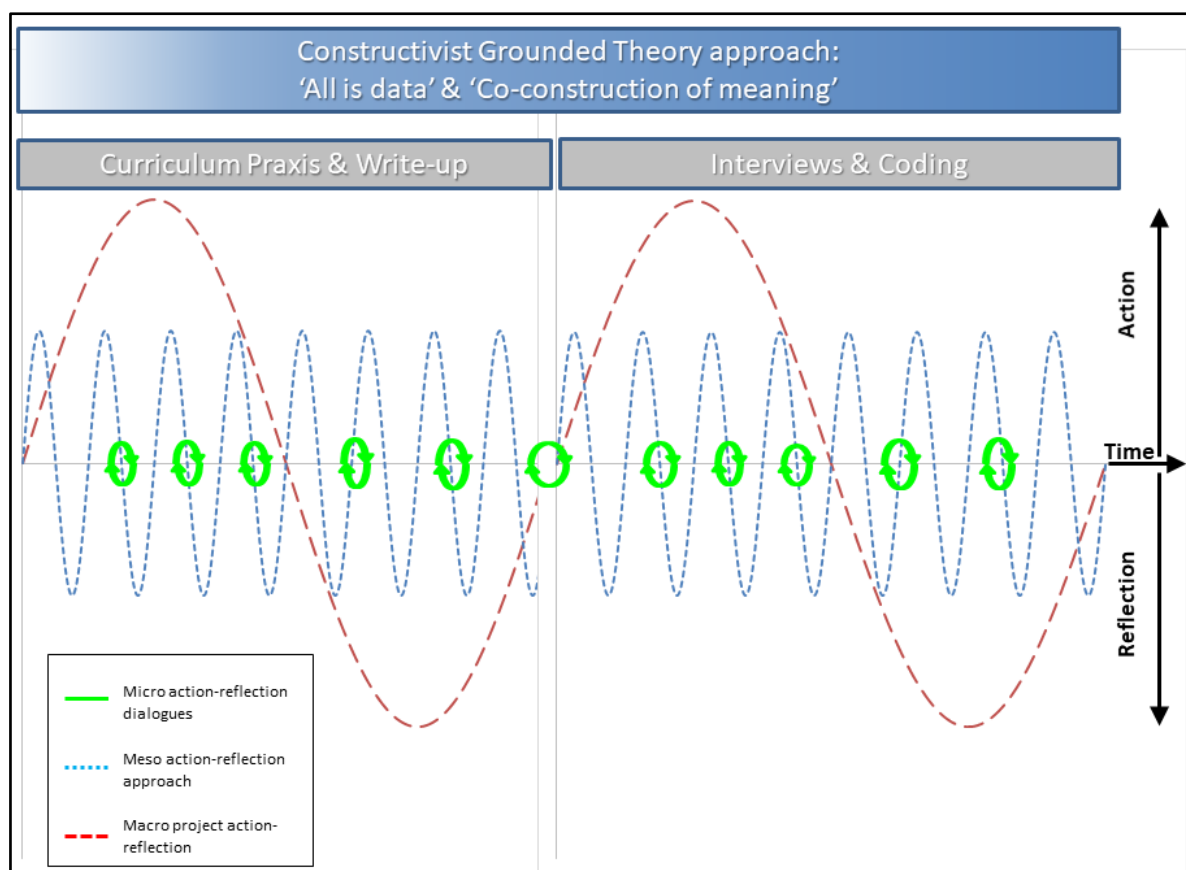


Figure 8.1: The current research project depicted using the lens of iterative action-reflection at macro-, meso-, and micro-scales.

Figure 8.1 illustrates this research project as comprising two macro iterations of action and reflection. The first iteration is detailed in Chapter 6, and comprised a soil science teaching praxis (action phase), and subsequent write-up (reflection phase). The second macro iteration depicted, comprised the interviews (action phase) and subsequent theoretical coding and thesis write-up (reflection phase). In the second iteration, the individual interviews and supervision discussions constituted the micro action-reflection dialogues. Meso action-reflection iterations can, for example, be representative of concurrent participation in conferences, interview transcription and advancing coding and memoing, and thesis chapter write-up and revision.

Importantly, the research project can be seen to have an overarching CGT methodology. This enabled previous macro iterations of action and reflection to be used as data for reflective memoing and theory production. While the first macro iteration was less formally coded, it contributed to the development of the CGT produced, and thus is encompassed within the

overarching methodology. This holds with the well-known dictum of Glaser that “all is data” (Glaser, 2012:1). Moreover, it is also congruent with Charmaz’s (2005) CGT approach in which the researcher, through their previous and present subjective experiences, co-constructs meaning with research participants. As Charmaz’s (2005:509) details:

what observers see and hear depends upon their prior interpretive frames, biographies, and interests as well as the research context, their relationships with research participants, concrete field experiences, and modes of generating and recording empirical materials. [...] In short, we share in constructing what we define as data. [...] The discovery process consists of discovering the ideas the researcher has about the data after interacting with it.

Thus, on reflection upon the focused and theoretical codes produced from the rigorous coding of the interviews, it can be seen that theoretical ‘golden threads’ had antecedents in the micro action-reflection dialogues model produced in Chapter 6. In particular the three focused codes, *Dialogue and Connection*; *Reflection: Questioning Deeply*; and *Personal and Professional Journey*, can be discerned in Figure 8.1. Specifically, dialogue and reflection are included as fundamental to the model’s micro-dialogues and meso-cycles; while the two macro iterations depict a professional learning journey. This model does not however integrate *Hindrances to Africanising Curricula*, which were important in spurring transformation, and is accordingly discussed next.

8.1.2 Limitations as Epistemological Affordances

In the process of this research project, limits to the conception of Africanisation and consequent progress were encountered. Often however, such barriers were only apprehended upon reflection. For example, an initial attempt at Africanising a soil science curriculum sought to integrate meaningful pedagogical practices and additive South African examples. At the time, this was an advancement on simply delivering a euro-centric textbook in a series of traditional-style lectures. Thus, limits to epistemic access were perceived, and Africanising efforts were made to go beyond these specific limitations (see Chapters 3 and 6). Nonetheless, subsequently understandings of Africanisation were deepened by engaging with the literature, conducting interviews with expert participants, and the CGT analysis. It was consequently perceived that regarding this teaching praxis (Chapter 6) as an end-point to Africanisation, would itself be a limit. Reflecting upon the apprehension of this ‘new’ limit, resulted in advancing guiding tenets for Africanisation – which included to valuing epistemic plurality and going beyond additive examples (see Chapter 7).

In other words, only once a factor was understood to be limiting of Africanisation, could the ‘limit’ be perceived as an ‘affordance’ to further transformation. An affordance can broadly be defined as “possibilities for action” (Evans *et al.*, 2017:36). While this term is generally used in user design literature, in this context, it has been adapted to epistemological considerations. Correspondingly, van Lier (2004:92) indicates that the term has been applied in a variety of contexts, and goes on to provide a refined definition of an affordance as “action in potential and it emerges as we interact with the physical and social world”. Thus, as applied here, in the context of enacting a soil science curriculum, an ‘affordance’ is the potential to advance Africanisation. However, to perceive an affordance, a barrier to Africanisation must first be understood. For example, until an academic perceives the epistemic inequity of science’s mono-episteme – as limiting the advancement of Africanisation – there is no potential to transcend this limit. Consequently, apprehending a limit is an ‘epistemological affordance’ of transformation. While it subsequently takes a process and effort to problem-solve transcending a limit, Africanisation cannot be advanced if limits to it are not perceived in the first place. Thus, within a developmental journey the successive identification of aspects which limit Africanisation occurs, which in turn, provides epistemic affordances (toward action) to transcend these barriers. To return to the illustrative example in this study, the understanding of the limitations of additive examples (see Chapter 6), became the epistemic affordance to ‘transformation beyond examples’ (see Chapter 7). Accordingly, Figure 8.2 depicts this basic conceptual building-block, while Figure 8.3 depicts this concept as illustrating the relationship between the three primary focused codes developed by the CGT analysis.

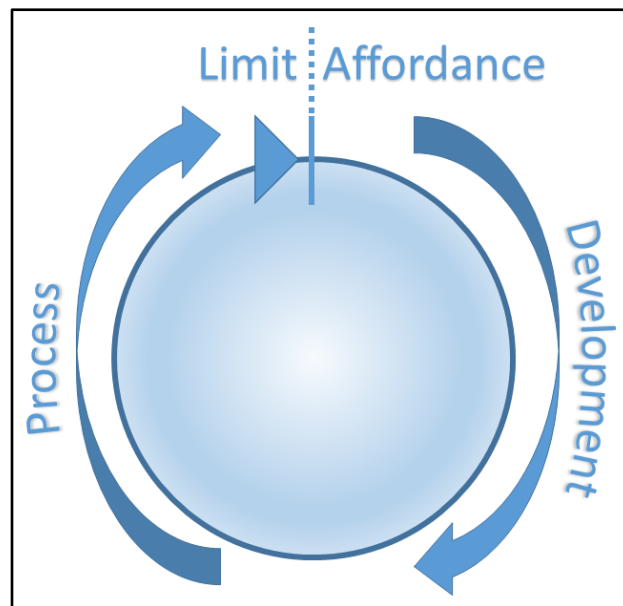


Figure 8.2: Limits as an epistemological affordance and the contingent development process.

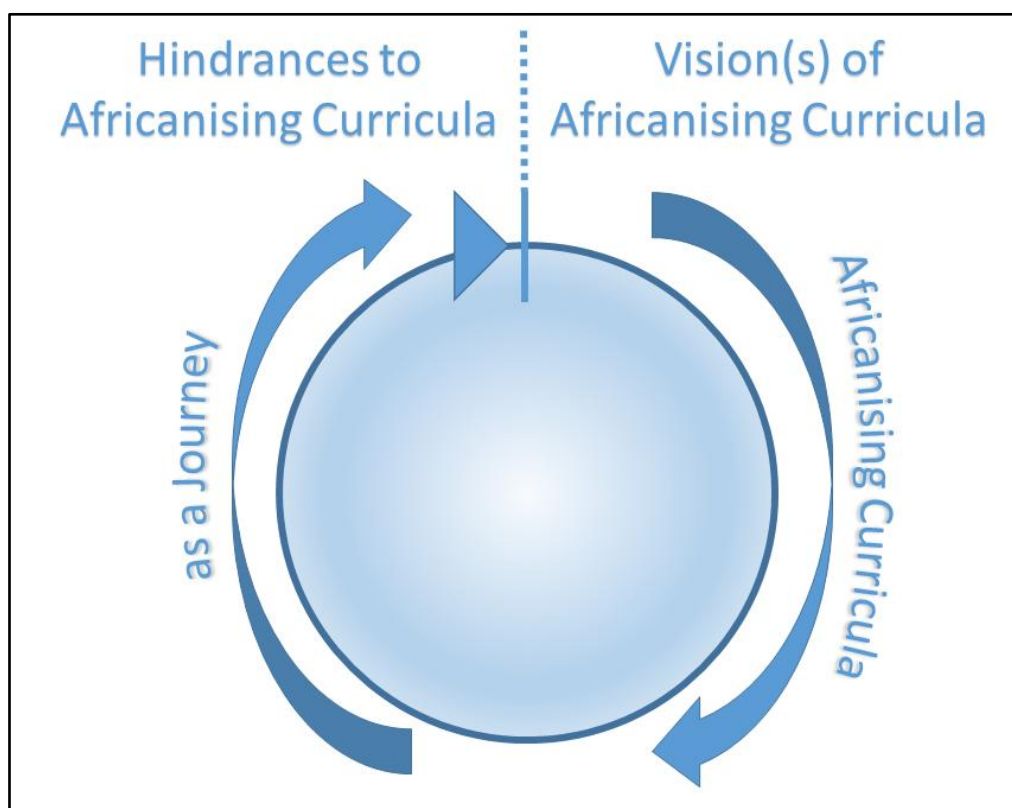


Figure 8.3: A personal and reflective developmental journey, of hindrances to Africanising curricula, being transformed into affordances of vision(s) of Africanising curricula.

Thus limits, although often perceived as a constraint or endpoint, viewed differently, can paradoxically become powerful affordances for epistemic transformation. There are various aspects to this conceptualisation of ‘limits as epistemic affordances’ as developed here. In particular, limitations can propel creative problem-solving. When advances to Africanisation are *prima facie* limited, innovation can be prompted. That is, apprehending the inequity of limiting approaches to teaching and learning can spur innovative thinking which seeks to transcend these limits and advance epistemic justice outcomes. Furthermore, limits provide a locus of focus. By identifying barriers, clarity is gained, toward which effort and action can be targeted, so as to forward transformation. Lastly, limits can foster development and resilience. Transcending restrictions increases capacity for adaptability and resourcefulness and engenders a positive attitude toward overcoming future barriers. Therefore, apprehending and engaging successive limits, as epistemic affordances, can support the advancement of an Africanising transformation of curricula. Put in other words, the reframing of limits not as barriers, but as pointers to directions for epistemic expansion, reconceives obstacles as opportunities. Accordingly, Figure 8.4 further develops the forgoing conceptual journey of a limitation, as an epistemological affordance, into the additional dimension of iterative development.

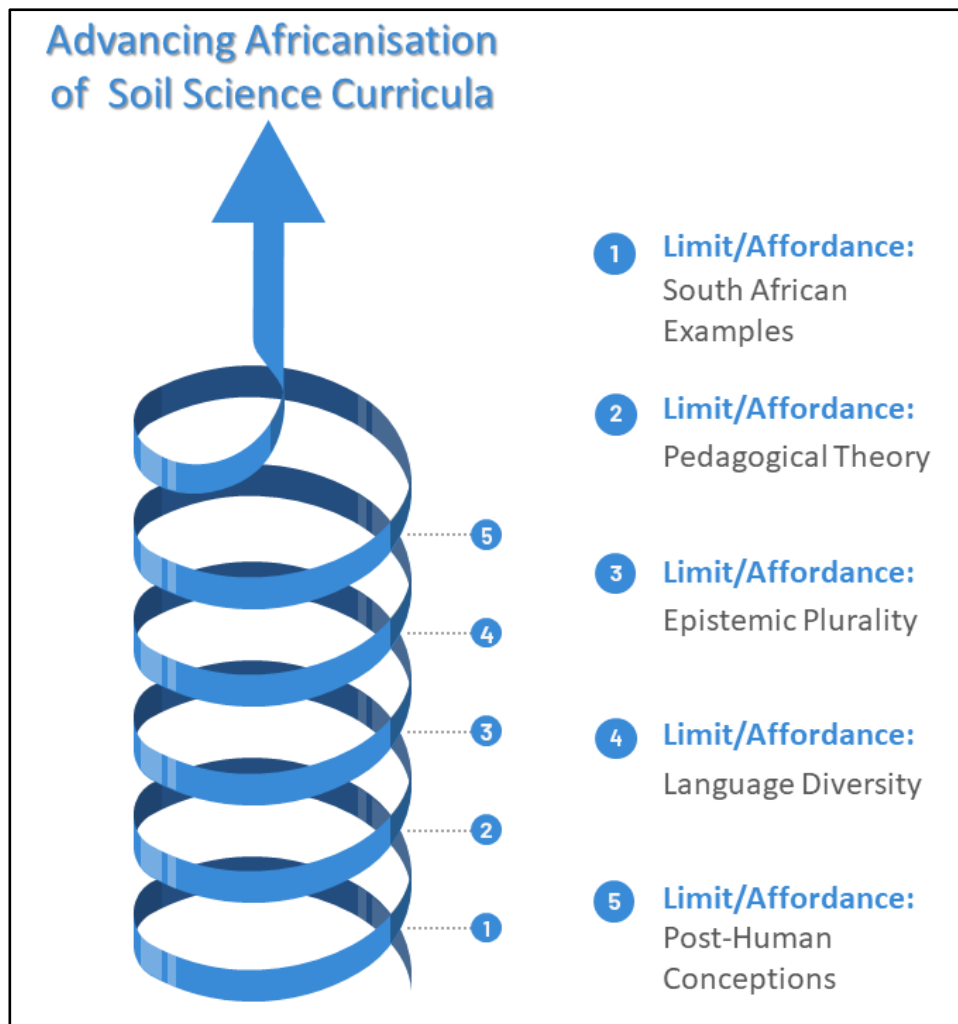


Figure 8.4: A journey of successive and iterative apprehension and consequent transcending of epistemological limits into epistemological affordances.

This study has taken practical and notional steps toward the Africanisation of an undergraduate soil science curriculum (see Chapters 6 and 7). This is conceptualised as iteratively identifying limits to Africanisation, and consequently envisioning (or enacting) the transcending of these limits. Accordingly, Figure 8.4 depicts (the five currently identified) limits/affordances to Africanising a curriculum. In this figure, the initial practical steps toward Africanisation are depicted as (1) including South African examples, and (2) integrating pedagogical theory. As the research journey developed beyond this point, science’s mono-episteme was apprehended as a subsequent limit. This engendered the epistemic affordance of ‘going beyond examples’ and integrating (3) diverse epistemics beyond examples into the curriculum. The subsequent limit foreseen is that of English being the sole academic language of soil science in the university. This invites the epistemic affordance to deepen Africanisation by (4) diversifying

language in the African university. This is an important step toward Africanisation, as language is intertwined with peoples' ontology and epistemology, and thus accords acknowledgement and respect (wa Thiong'o, 1981; Alexander, 2003; Chumbow, 2005; Meany *et al.*, 2012; Jacob *et al.*, 2015; Mayaba *et al.*, 2018). For example, Mchombo (2014:22) contend that "languages embody systems of knowledge that have cultural significance and practical utility." Thus, valuing a plurality of knowledges in the advancement of Africanisation, should also consider the plurality of languages in teaching and learning. Mayaba *et al.* (2018:1) highlight the epistemic injustice of English-only teaching and learning: "the issue of language should be recognised as a social justice issue, that student voice can enlighten curriculum designers and society on the dangers of reproducing inequalities through the hegemony of English". Critics could deem this an unmanageable undertaking to Africanise a soil science curriculum into African languages. This limiting perspective could nonetheless be transcended *if* it is seen as a valuable epistemic affordance in advancing Africanisation. Subsequent progression beyond this, may be a consideration of a soil science curriculum which seeks to embrace the (5) post-human or more-than-human world. That is to say, to expand views of soils beyond human-centric needs, to include diverse ethical considerations of agents such as plants, animals and the environment. This is a recent and evolving academic discourse on soils, although not one led by soil scientists (de la Bellacasa, 2019; Krzywoszynska, 2019; Salazar *et al.*, 2020; McElwee, 2021; Friedrichsen *et al.*, 2022; Granjou & Meulemans, 2023; Kallio & LaFleur, 2023; Davidson & da Silva, 2024; LeVasseur, 2024). Further analytical discussion of the post-human is however beyond the scope of this research. Regardless, it is illustrative of the far-reaching epistemic visions that Africanising curricula can move towards in seeking social and environmental justice.

Importantly, 'how exactly' these visions might be realised, is not determined before embarking on the transformative journey, but is necessarily emergent. This requires being open to transformation, as underpinned by commitments to social justice, valuing plurality, dialogue, and the interconnected African *ubuntu* context. The Africanisation of a soil science curriculum can then be iteratively advanced by our reflections, interactions, explorations, and willingness to embrace the unknown. Africanisation of curricula can thus become an unfolding journey of discovery, fuelled by curiosity and an understanding that limitations are not fixed, but rather temporary markers or invitations to transformation, on a path of epistemic growth. Consequently, synthesising these theoretical building-blocks (8.1.1 and 8.1.2) and the forgoing

guiding tenets produced by the CGT process (Chapter 7), culminated in a theory of: *Africanisation as a ‘personal ubuntu’ process*. – as detailed in the next section.

8.2 Africanisation of Curricula as a ‘Personal *Ubuntu*’ Process: A Constructivist Grounded Theory

The CGT production-process was a culmination of the synthesis of the forgoing literature on Africanisation (Chapter 2 and 3), WSS and LSKs (Chapter 4), researcher memoing and reflections and teaching praxis (Chapter 6 and 7), focused and theoretical codes (Chapter 7), and conceptual building-blocks (Chapter 8). This produced a CGT of a (South) Africanised soil science curriculum-transformation process. This CGT is underpinned by the guiding tenets for Africanising a soil science curriculum as represented in Table 8.1 (see Chapter 7 focused and theoretical codes).

Table 8.1: Guiding tenets for Africanising a soil science curriculum and references to sub-sections in Chapter 7.

Focused CGT Codes	Theoretical CGT Codes
Status Quo: Tensions and Limitations (7.3.1.1)	Hindrances to Africanising Curricula (7.3.1)
Transformation as Local Examples (7.3.1.2)	
Personal and Academic Journey (7.3.2.1)	Africanising Curricula as a Journey (7.3.2)
Reflection: Questioning Deeply (7.3.2.2)	
Social Justice Aims (7.3.3.1)	Vision(s) of Africanising Curricula (7.3.3)
Valuing Plurality and Indigenous Knowledges (7.3.3.2)	
Dialogue and Connection (7.3.3.3)	
Fit for Purpose and Learning Context (7.3.3.4)	
Transformation as Process: Beyond Examples (7.3.3.5)	

The CGT is represented in Figure 8.5, and is termed: Africanisation of curricula as a ‘personal *ubuntu*’ process. The theory is subsequently discussed, in light of the guiding tenets and theoretical building-blocks which informed its production, and includes references to pertinent sub-sections.

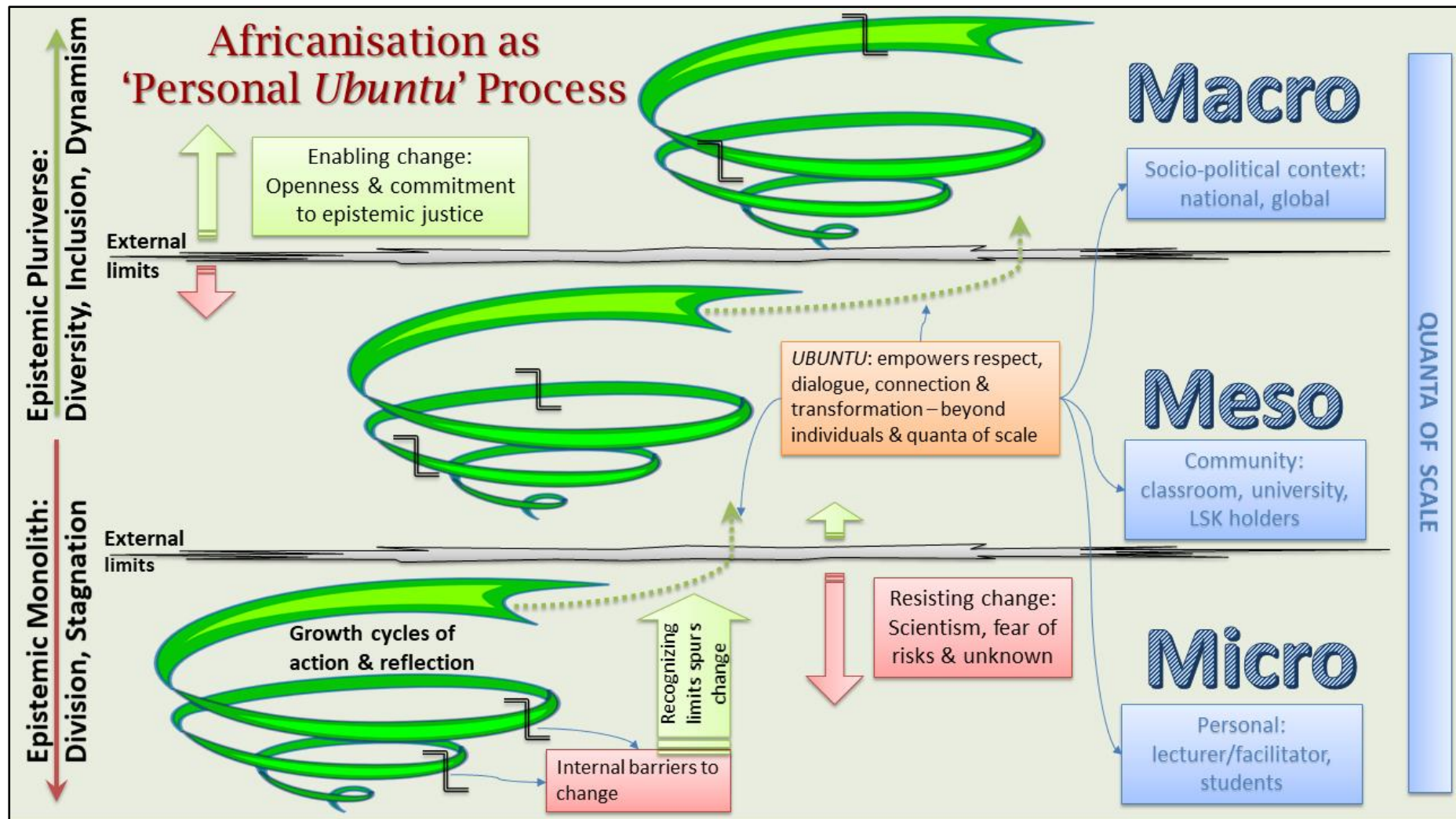


Figure 8.5: A constructivist grounded theory of Africanisation of curricula as a 'personal *ubuntu*' process.

The CGT theory in Figure 8.5 posits that Africanisation is a transformative epistemic growth process for soil science lecturers/facilitators, as well as students (7.3.3). This is depicted by the advancing spirals of epistemic expansion, beyond narrow conceptions of soil science. This widening epistemic trajectory is comprised of ongoing macro-and meso-cycles of action and reflection; along with engaging in micro action-reflection dialogues (8.1.1). These are not depicted in Figure 8.5 due to limits of scale. However, it can be understood that action-reflection cycles constitute the upward spirals of long-term epistemic expansion required by the Africanisation's valuing of plurality and going beyond examples (7.3.3.2; 7.3.3.5). This process is necessarily grounded in the personal, and is advanced by engaging in meaningful epistemic dialogues, as nurtured by a sense of *ubuntu* (7.3.3.2; 7.3.3.3). In Figure 8.5, *ubuntu* can be seen as the exercising of an African philosophy which advantageously connects various actors (academics, students, LSK holders) across multiple scales, to forward the Africanising of curricula (7.3.3.3). A desire for growth, inclusivity and epistemic justice fuel the continuation of this epistemic-expanding learning engagement (7.3.2.1; 7.3.3.1). These are depicted by 'enablers of change' in Figure 8.5. In conjunction with this, it is the recognition of successively apprehended limits, upon the journey of this expanding epistemic spiral, which spurs (or hinders) further transformation (7.3.1; 8.1.2). Transforming these limitations into affordances (i.e. potential sites for action), requires reflection, vulnerability and openness to change as a process (7.3.3; 8.1.2). Conversely, resistance to change is due to an over-reliance on a western science epistemic as universally explicative (7.3.1). Attendant to this resistance to transformation are fears of risking uncertainty and engaging the unknown (i.e. other epistemics) (7.3.1). These hindrances are depicted by 'resistances to change' in the Figure 8.5. Notably, these are in opposition to epistemic openness and a trust in engaging in a world-view-expanding process of Africanisation (7.3.3.5). Advancing Africanisation requires understandings of the value of Africanising curricula, and the guiding tenets which enable this, namely: social justice aims (7.3.3.1), valuing plurality and indigenous knowledges (7.3.3.2), dialogue and connection (7.3.3.3), fit for purpose and learning context (7.3.3.4), transformation as process: beyond examples (7.3.3.5). This means that there is categorically no tick-box approach, which is a meaningfully transformative solution to Africanising a soil science curriculum (7.3.1.2). Importantly, due to the personal, collective, dialogic and contextual nature of this theorised process, an Africanised soil science curriculum emerges as unique and dynamic and adaptive (7.3.3.4). For this reason, advancing Africanisation can support local contexts' social and environmental justice needs (7.3.3.4). Importantly the theory, connected by a practice of *ubuntu*, operates at a plurality of scales: the micro (curriculum), meso

(institutional), and macro (national and global) (7.3.3.2). Figure 8.5 depicts these scales as positively or negatively influencing each other; where a groundswell can for example push institutional change, or national policy can make space for Africanisation to be advanced. Conversely, these may also be external limitations in quanta of scale; for example, university assessment policies may hinder Africanisation.

The theory thus encompasses interconnected personal, institutional, and national transformation processes, in a synergy of African (*ubuntu*) and western (individualistic) approaches. In summation, the theory proffers the following integrated process for advancing the Africanisation of a soil science curriculum:

- by reflexive recognition of local limiting factors and injustices in these domains,
- the risk of transcending limits is overcome and transformation for inclusion of African epistemai is spurred;
- the continued momentum of which is fuelled by a student-centred desire for epistemic and social justice,
- while resistances are entrenched by scientism, fears of the unknown and accompanying loss of western scientific certainty and control.

Furthermore, due to its increased theoretical abstraction, this CGT may usefully be extended to other environmental sciences. Disciplines with established ethnological literature, such as ethnobotany, ethnozoology, ethnoecology, and ethnoastronomy may lend themselves to this proposed process due to existing connections to IKS. Thus, as discussed in the next section, an Africanised curriculum can become the site of the production of new Africa-centred knowledge.

8.3 Africanisation of Curricula as Mode 2 African Knowledge Production

Building on the foregoing CGT, this research further posits that Africanisation is an effective site for Mode 2 African knowledge production. In the transdisciplinary literature, ‘Mode 1’ and ‘Mode 2’ knowledge production have been distinguished (Gibbons *et al.*, 1994; Nowotny *et al.*, 2001). Mode 1 knowledge is deemed traditional ‘siloeed’ disciplinary knowledge (i.e. the canon), while Mode 2 is socially distributed and reflexive knowledge production (Waghid, 2002). Nowotny *et al.* (2003:179) detail the characteristics thus:

The old paradigm of scientific discovery (‘Mode 1’) – characterized by the hegemony of theoretical or, at any rate, experimental science; by an internally-driven taxonomy of disciplines; and by the autonomy of scientists and their host institutions, the universities – [is] being superseded by a new paradigm of

knowledge production ('Mode 2'), which [is] socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities.

Accordingly, Sigl *et al.* (2023) advocate for academic soil science to transition from the university-based Mode 1 knowledge production, to a transformed Mode 2 approach, which co-produces knowledge with diverse stakeholders. In this regard, the authors argue for three avenues for transformative integration of knowledges in the discipline of soil science:

1. connecting soil science to wider social and environmental issues, which in turn require transformed research practices;
2. integrating soil science with other diverse soil-related research; and
3. integrating soil science with social sciences (e.g. sociology and economics), along with stakeholder knowledge, to create more sustainable soil management solutions.

This transformative epistemic move seeks to challenge the discipline of soil science towards more holistic and integrated research approaches that connect it to broader societal concerns and incorporate diverse perspectives (Sigl *et al.*, 2023). Such an approach is supported by Bruyn *et al.* (2017:427):

Blurring the lines between knowledge generator and user will encourage solutions for the sustainable use of soil from outside traditional knowledge-holders. We suggest the solution [...] is to invest in relationships and social networks to foster understanding of soil-building practices and achieve wider [generation and] adoption of technologies.

It is thus proposed here that, in Africanising the (South) African university soil science curriculum beyond additive examples, a new site emerges to co-produce epistemically just Mode 2 African knowledge and thereby expand the soil science epistemic. In other words, Africanising curricula could contribute to shifting historical biases in the canon of soil science. Figure 8.6 depicts this assertion and is explained below.

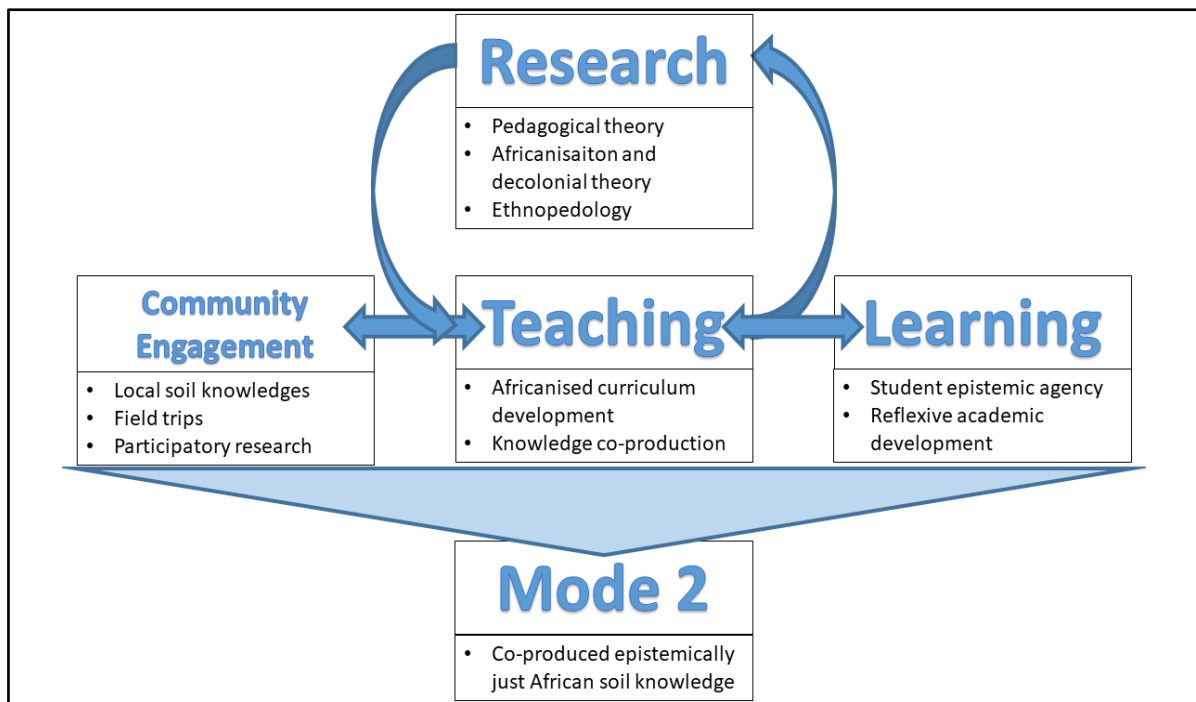


Figure 8.6: Africanising the (South) African university soil science curriculum as a site for Mode 2 African knowledge production.

In working to enact the proposed CGT of ‘Africanisation of curricula as a ‘personal *ubuntu*’ process’ (see Section 8.2), new socially distributed and reflexive Mode 2 African knowledge is potentially generated. In necessarily fostering students’ epistemic agency to co-participate in the Africanisation of a curriculum, knowledge is co-constructed. In this, the academic facilitator of the curriculum, in practicing reflexivity, can in turn learn from interacting with student knowledges (7.3.3.4), and integrate them into the curriculum. Similarly, respectful dialogue with and connection to local communities, welcomes LSK knowledges into the curriculum development space (7.3.3.2). This may extend to field trips and participatory research. In such engagement, the Africanised curriculum again is a site for expanding the discipline’s epistemic. Lastly, in an academic’s personal and professional development, and by way of engaging in research into pedagogic theory, Africanisation and decolonial theory, and ethnopedology – a plurality of knowledges are brought to the process of Africanising a curriculum (7.3.2.2). In a synthesis of these three intersecting areas: student knowledge, community LSKs, and transdisciplinary knowledge – there is a powerful locus in the process of Africanising the curriculum to produce new Mode 2 African knowledge for the discipline. Importantly, this may offer new epistemically just knowledge to the canon, and contribute toward shifting the historical biases in soil science epistemics.

8.4 Discussion

While the foundational tenets of the foregoing CGT have been thoroughly discussed in light of existing literature (see Chapter 7), this section shall discuss this study's CGT as a construct. There is nonetheless a lack of CGT studies which produce a construct for Africanising soil science curricula. Thus, for the purposes of critical evaluation of this CGT, this discussion reflects on prior research regarding process-based approaches to transformation and curriculum Africanisation.

Relevant to the transformation process, Benvenuti *et al.* (2022) studied how academics' learning evolved through reflective practice, which focused on the integration of pedagogical theory with their disciplinary expertise (see Figure 8.7).

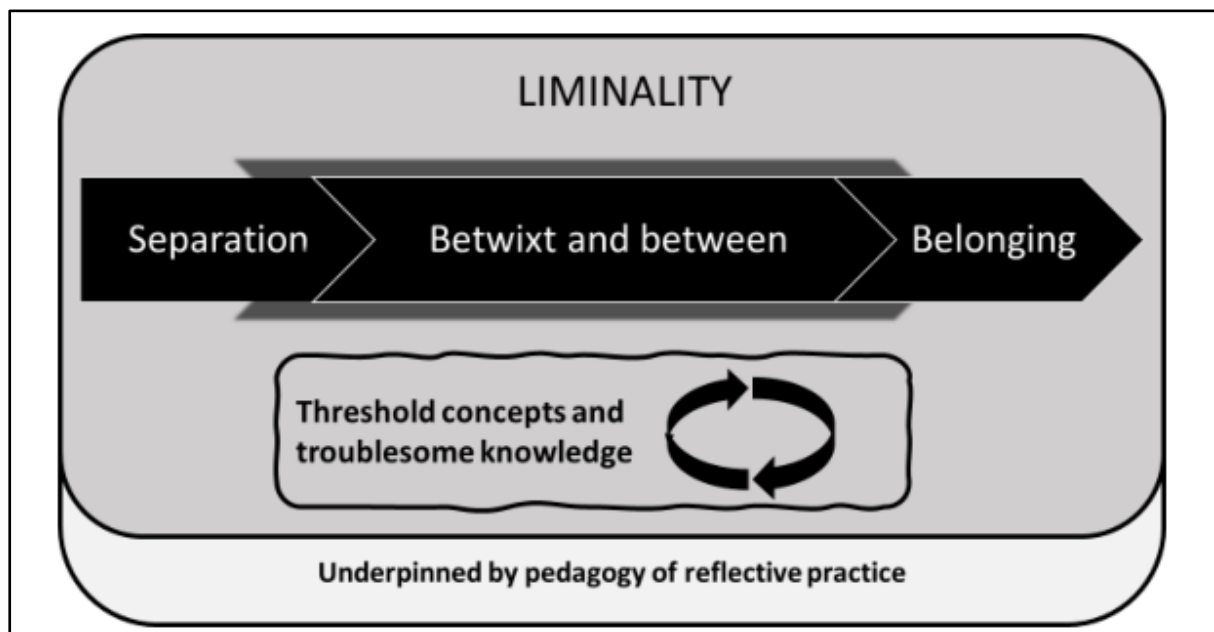


Figure 8.7: Visual representation of the three phases of liminality, incorporating the notions of threshold concepts and troublesome knowledge, as underpinned by a pedagogy of reflective practice (Benvenuti *et al.*, 2022).

Parallels can be drawn between Figure 8.7 and the CGT proposed here (see Section 8.2). Firstly, a reflective practice is fundamental to the advancement of both processes. Secondly, this CGT study theorises limits being transformed into affordances by a learning journey; while, Benvenuti *et al.* (2022) analogously posit: separation as a precursor to being betwixt and

between, till epistemic belonging is achieved. In other words, both transformation processes highlight the importance of limits/troublesome knowledge, as being the site of initiating a learning journey to an expanded sense of understanding. Benvenuti *et al.*'s (2022) study focused on the transformative learning from disciplinary-only knowledge in academics, to their integration of pedagogical knowledge. This study's CGT process however presents a broader, more theoretical iterative curriculum Africanisation process, operating at various scales, while also highlighting factors that support its advance, and those that hinder it. Kamwendo (2016) supports this, in arguing that Africanisation of curricula should extend transformation to include the institution's philosophy, mission, vision, strategic plan, student and staff bodies, and research agenda. While Leibowitz (2016:77) affirms that, "'curriculum' can be plotted on a continuum from design choices at the micro level to choices at the macro level", making Africanisation at all these scales relevant.

In turn, Le Grange (2014) makes an argument for Africanising curricula by way of the method of active *currere*⁴⁴. This method of *currere*, developed by Pinar (2004:37), reframes curricula and their development as:

a complicated conversation with oneself (as a "private" intellectual), an on-going project of self-understanding in which one becomes mobilized for engaged pedagogical action—as a private-and-public intellectual—with others in the social reconstruction of the public sphere.

Thus, autobiographical reflections are fundamental to advancing learning in both the method of *currere* (Msiza, 2020; Simmonds, 2020), and the CGT developed here. Interestingly, Pinar cites African-American autobiographical emancipation accounts of becoming in the development of this method, in that it seeks also to centre "self-understanding, self-affirmation, self-mobilization, and collective action" (Pinar, 2004:5). Le Grange (2014: 1288) extends the argument for this method of *currere* in observing that "[t]he conceptual power of *currere* implies newness, the creation of things unforeseen, experimentation, and the expansion of difference and movement." Similarly, this study's CGT proffers a personal and collective developmental process, which embraces the unknown. In this vein, this CGT process is also antithetical to a pre-determined checklist for delivering an Africanised soil science curriculum.

⁴⁴ *Currere* is the Latin root of the word 'curriculum', and means 'to run'. In this, the so called method of *currere* emphasizes the dynamic unfolding process and lived experience of learning, rather than the content of what is being learned (Le Grange, 2014).

Rather, it proposes tenets and a process for reflective, contextually connected, socially just, epistemic expansion within curriculum development and enactment.

With regards to the aims of Africanisation of curricula, various authors (Nyamnjoh, 2012; Ndofirepi, 2014; Luckett & Shay, 2017; Le Grange, 2018; Meyiwa *et al.*, 2020; Sebola & Mogoboya, 2020; Swartz *et al.*, 2020) have collectively identified that Africanisation of curricula should seek to: (1) deconstruct epistemic and power imbalances within disciplines, and (2) create new African-centred knowledge. The CGT proposed here accommodates advancing both of these aims. Firstly, the identification of ‘hindrances to Africanisation’ in this CGT process can usefully focus on the deconstruction of western epistemics in a discipline (see Chapters 3 and 4). Secondly, this study contends (see Section 8.3) that the process of Africanising curricula – being a nexus for reflective scholarship and teaching, along with engaging community and student knowledges – is a meaningful site for Mode 2 knowledge production.

Moreover, this new epistemically just Mode 2 knowledge construction, can usefully contribute to countering epistemicide. In this regard, de Sousa Santos (2014) outlines three key propositions in undermining epistemicide, namely: (1) embracing ways to understand the world go far beyond the prescriptive definitions of western science; (2) the attaining of global social justice, needfully requires embracing global cognitive justice; and (3) the emancipatory transformations needed to achieve this global cognitive justice, cannot be achieved solely by way of western-centric critical theory – but by necessarily valorising and embracing a diversity of epistemics. As Africanisation seeks to counter epistemicide, these suggestions can be useful indicators of a suitable curriculum transformation process. In the case of this study’s CGT, engaging in the process would: (1) advance beyond narrow canonical prescription; (2) be driven by and aim for epistemic justice; and (3) develop a Mode 2 Africanised curriculum from a diversity of contextually appropriate knowledges. Thus, in turn, each of de Sousa Santos’ (2014) guidelines are met by the proposed CGT. Nevertheless, as Kamwendo (2016:29) argues, Africanisation should not “breed academic silos”, nor categorically reject western knowledge but seek (as this CGT advocates), an accumulative synergy of knowledges. Such an approach is also congruent with Cornwell’s (2006) recommendation to reject essentialism, and

foreground a humanist, contextually appropriate and thus socially just curriculum Africanisation.

Regarding the process-based nature of transformation, Khosi and Vráblíková (2020) reflected on the process of running a ‘Decolonial Reading Salon’ which they implemented at a South African university. It collectively engaged staff and students in discussing decolonial theories (including Africanisation). The authors found that this praxis was a successful site for what Mignolo (2009) terms ‘epistemic disobedience’ and practicing non-hierarchical teaching and learning (where no one person holds epistemic authority). Over time, this led to transformations in the thinking of participants about teaching and learning. They also note that it was incredibly ‘hard work’, intellectually, emotionally, and administratively. Potokri (2016) likewise highlight that a process-based personal and collective commitment to Africanisation can largely determine its success. Similar non-hierarchical epistemic diversification and learning are proposed in this study, with student-centeredness and connections to community knowledge being foregrounded. Additionally, the process-based nature of this CGT is not a facile short-term project, but an on-going personal and communal commitment to iteratively ‘discovering’ epistemically just curricula.

In the development of this study’s CGT, both the theoretical process was proposed (Section 8.2), as well as demonstrating three progressive iterations of the process (see Figure 8.4), namely: adding South African examples (see Chapter 6), integrating pedagogical theory (see Chapter 6), and advancing epistemic plurality (see Chapter 4 and 7). With reference to these demonstrated advances, as to how a soil science curriculum might be Africanised, these outcomes are compared in Table 8.2 against Botha’s (2007) recommendations for Africanising curricula. As demonstrated in Table 8.2, the study successfully fulfils these recommendations.

Table 8.2: A comparison between Botha’s (2007) recommendations for Africanising curricula, against advances in Africanising a soil science curriculum made by this study.

Recommendations in Africanising curricula (Botha, 2007)	Advancing Africanisation of curricula in this study
Acknowledge the multifaceted nature of curriculum Africanisation and pinpoint context-specific complexities.	Chapters 2, 4 and 7
Gather insights from knowledgeable individuals about past experiences related to curriculum change.	Chapters 5, 6 and 7
Define and analyse the concept of Africanising the curriculum within the specific context.	Chapters 2 and 7
Explore limitations surrounding Africanisation and develop strategies to address them.	Chapters 2, 7 and 8
Assess the representation of African and non-African elements in the curriculum based on gathered data.	Chapters 3 and 4
Evaluate ‘add-on’ and ‘integrated’ approaches to Africanising the curriculum.	Chapters 7 and 8
Develop a context-specific content and process model for curriculum Africanisation based on all findings.	Chapter 8

Lastly, while the departure point for this study has been the frame of Africanisation, it has overlapped with related discourses on decolonisation, decoloniality and indigenisation. For example, Bainbridge *et al.* (2019) argue that grounded theory is well suited to decolonial research, as it has pragmatic and social justice roots which were a rejection of positivism in the then social sciences. It is argued here, that this study’s CGT study may also be a good conceptual fit for the ‘purposes’ (as per Maringe, 2021:16) of each of these related transformation discourses, namely:

- Africanisation, by elevating African identity and culture.
- Decolonisation, by replacing colonial artefacts, concepts and knowledge with local knowledge.
- Decoloniality, by addressing the issues of epistemic change.
- Indigenisation, highlighting and prioritising local knowledge.

Moreover, as found by Mashiyi *et al.* (2020:161) in their study, “lecturers who teach the same subjects may hold different views on how to implement decolonisation in their subjects”. The contextually-rooted (and thus unique) applications of this study’s CGT, allow for varying views

on how to realise such change. Nonetheless, this CGT's guiding tenets (such as student-centeredness and social justice aims), work to ensure that there is a common direction in implementing substantive Africanisation. It is such "shared understandings" which will advancing the goal of transformation (Mashiye *et al.*, 2020:146). Thus as Nyamnjoh (2012:20) argues, such an Africanisation CGT process, underpinned by its own *ubuntu* values, is robust and inclusive as "[e]pistemological conviviality and interconnection are possible precisely in light of the spirit of tolerance for which Africans are renowned, and in recognition that there are no final answers to perplexing questions in a dynamic world".

The foregoing discussion demonstrates that the tenets and propositions of this study's unique CGT are supported by the literature. The CGT produced here is well-aligned with the transformation literature, likely because it was chiefly grounded in interviews with academics – many of whom were to some degree familiar with it. However, this was only apparent after the CGT analysis, as the in-depth literature reviews (Chapters 2 and 4) were only written after the coding analysis was conducted (as per Section 1.6). Therefore, as demonstrated here and as advocated for in the literature, the CGT produced by this research is sufficiently abstracted and consequently theoretically powerful enough to meaningfully encompass diverse facets of Africanisation as curriculum transformation.

8.5 Conclusion

This chapter has presented theoretical building-blocks which were developed from analyses and reflections in forgoing chapters (Chapters 6 and 7). These theoretical-building blocks are useful in their own right in conceiving facets of an Africanising transformation process. Consequently, a synthesis of these building-blocks and Chapter 7's guiding tenets, resulted in a CGT with sufficient explanatory power to detail a process for meaningfully advancing the Africanising transformation of soil (and other environmental) science curricula. The theoretical capacity of this unique CGT was compared to the existing literature in the research area to validate facets of it. The subsequent chapter sums up and concludes this study.

CHAPTER 9: CONCLUSIONS

9.1 Introduction

The words of Kappelar (1986:212) usefully frame this conclusion:

I do not really wish to conclude and sum up, rounding off the argument so as to dump it in a nutshell on the reader. A lot more could be said about any of the topics I have touched upon, many more examples could be adduced [(i.e. cited)], further connections be made. I have meant to ask the questions, to break out of the frame [...] to make us look [...] in other ways. The point is not a set of answers, but making possible a different practice, of seeing, of questioning, of critique, of infidelity to the dominant vision, of hollowing out from within [and advancing an African epistemic through curriculum development].

This study has detailed a part of an unfolding and ongoing learning journey. Accordingly, I have endeavoured to render the nuanced, organic processes of learning (along with its inherent complex interactions and reflective insights), into the framework of a standard doctoral thesis. I have done my best to fit an organic human learning experience, its interactions and its reflective insights, into the formal structure of a doctoral thesis. Yet, equally, the rigour of academic research has iteratively refined my conceptualisation of how to advance epistemically just teaching and learning of soil knowledges in African universities. Accordingly, this chapter briefly summarises the key outcomes of the study and answers the research questions which the study tendered in Chapter 1. It goes on to provide a consistency matrix, validating the internal alignment between key aspects of the research. Researcher reflections are reported upon, providing insights into the research process and making suggestions for activities to advance the Africanisation of soil science curricula. Grounded theory quality and reporting criteria are then applied to further evaluate the success of the study. Lastly, limitations of the study are then presented, followed by recommendations for future research, and a summative conclusion.

9.2 Key Contributions of the Research

This section summates the unique contributions of this study, with particular reference to the ultimate CGT produced. It is thus relevant to recall here the initial aims of this study (see Section 1.3):

1. To identify a suite of guiding tenets which inform the process of Africanising a tertiary soil science curriculum.
2. To produce a theory as to how a pedagogue may deeply engage in the process of meaningfully Africanising an undergraduate soil science curriculum.

The following synthesis accordingly first provides a narrative explanation of this research's fulfilment of these aims and its contributions. Subsequently, a consistency matrix provides a point-form synopsis as to how these aims were met through an aligned research process to produce the study's outcomes (see Table 9.1).

This work has unearthed that, for a truly beneficial Africanisation of soil science to take place, approaches to curriculum must undergo a fundamental epistemic shift. This shift must extend beyond surface-level changes to a deep and continuous engagement with the socio-cultural context and epistemic diversity inherent in the African locale. This process began with a critical interrogation of existing curricula and disciplinary canons, in order to identify and dismantle euro-centric biases and mismatches that render them contextually inappropriate and alienating. These critiques create 'spaces' where problematically euro-centric content and epistemologies can be supplanted by African-centred alternatives. This offers an opportunity to develop a curriculum grounded in the locale's socio-cultural epistemologies and, importantly, suited to the specific needs of previously marginalised African communities and alienated students. Consequently, Africanising soil science curricula must incorporate elements that foster respect for these diverse contexts and their knowledges, thereby aiming to meet the varied needs of land users and students. In actualising this, academics need to adopt a student-centred approach to understand the epistemic diversity of the student body. Establishing respectful dialogue with students allows for the inclusion of curriculum elements that interface with, and build upon, their existing knowledges. Such an approach creates a learning experience that is relevant, engaging, empowering and epistemically just. This pursuit of epistemic justice, a core tenet of Africanisation, is advanced by valuing the plurality of knowledge systems and other epistemics. Valuing plurality allows for the establishment of genuine connection and meaningful dialogue with both students and LSK holders – thereby enriching the curriculum with diverse perspectives, and ensuring its (dynamic) contextual relevance. This dialogue, in turn, facilitates the adaptation of the curriculum to the specific needs of students and the unique characteristics of the African locale.

By moving beyond including additive African examples, and instead fundamentally and equitably synthesising African and western epistemologies, the curriculum can truly deliver on the aims of social justice. This transformative process is iteratively propelled by an ongoing reflective recognition of limiting factors and injustices, which, paradoxically, allows for the transcendence of these very limits and spurs the inclusion of African epistemes. The continued momentum of this transformation is fuelled by an Africa-centred desire for both epistemic and social justice. This process is nonetheless, not without its challenges. Resistance to Africanisation can stem from entrenched scientism, fears associated with exploring the unknown, and the epistemic discomfort of a loss of western scientific certainty and control. Despite these challenges, a commitment to epistemic justice, coupled with deepening understandings of the African context and a student-centred approach, are key to the process of advancing meaningful and lasting curriculum transformation. Importantly, these understandings can be catalysed and deepened by engaging in the domains and practices of pedagogy, Africanisation, decolonisation and IKs, while reflective learning embeds transformed understandings. Moreover, values such as respect, humility, openness, curiosity, care, empathy and *ubuntu* support this process. Importantly, in turn, an (in-process) Africanised curriculum becomes an epistemic nexus, between local community soil knowledge, western science, student knowledge, and academic research and reflection – for the creation of socially distributed and reflexive Mode 2 knowledge. In this manner, rather than generating knowledge which is subservient to euro-centric epistemic traditions, the African university can come to claim its place as a producer of its own knowledge and epistemics.

The CGT proposed by this study offers a means to meet both of the primary goals put forward by advocates of Africanisation, namely: (1) the critical deconstruction of euro-centrism in the discipline, and (2) generating new African soil knowledge (Nyamnjoh, 2012; Ndofirepi, 2014; Naidoo, 2016; Luckett & Shay, 2017; Le Grange, 2018; Meyiwa *et al.*, 2020; Sebola and Mogoboya, 2020; Swartz *et al.*, 2020). Thus, as uniquely advanced by the CGT presented here, both of these goals can specifically be forwarded at the site of a soil science curriculum, by utilising the guiding tenets and transformation process advanced here. While the forgoing literature has suggested the goals of Africanising curricula, it has not provided an *implementable process* which can guide soil scientists (and possibly other environmental scientists), as to *how* to go about Africanising a curriculum. This study thus addresses a significant gap in the development of an Africanised soil science curriculum. Table 9.1 below

accordingly reiterates the tenets proposed by this study to advance the Africanisation of curricula and includes a condensed explanation. However, it must be noted that these tenets are interrelated and process-based, and should therefore not be read or employed without understanding the context of the synthesised CGT advanced by this study (see Section 8.2).

Table 9.1: Guiding tenets and condensed explanation for advancing the Africanisation of undergraduate soil science curricula.

Overarching Tenets	Detailed Tenets	Condensed Explanation
Hindrances to Africanising Curricula	Status Quo: Tensions and Limitations	Hindrances to Africanising curricula are identified; these include additive examples and overlooking epistemic justice in Africanising curricula.
	Transformation as Local Examples	
Africanising Curricula as a Journey	Personal and Academic Journey	In apprehending hindrances to Africanising curricula, a personal and reflective journey is spurred to transcend them.
	Reflection: Questioning Deeply	
Vision(s) of Africanising Curricula	Social Justice Aims	Aims of socially and epistemically just curricula, engender unfolding visions of Africanised curricula which value a plurality of knowledges, foster dialogue and connection, ensuring they are fit for purpose and the learning context, and thereby engage Africanisation as a process, which iteratively transcends prior conceptual limits.
	Valuing Plurality and Indigenous Knowledges	
	Dialogue and Connection	
	Fit for Purpose and Learning Context	
	Transformation as Process: Beyond Examples	

This study has led by example and represented the implementation of the first stages of such an Africanising process, the initial reflective learnings that resulted, and the subsequent proposed possible advances. These are practical, and importantly, novel recommendations for advancing Africanisation in the discipline of soil science. These include demonstrating deconstructions of the euro-centrism of the current canon, along with suggestions for developing new knowledge by engaging in a (re)curriculating process in the nexus between academics, students, and LSK holders. This research has successfully brought a wide range of

ideas together, and through rigorously synthesising them, proposed a workable methodological process for Africanising soil science curricula and concurrently producing African knowledge.

These key contributions are applicably contextualised within the research process, by employing a consistency matrix. A research consistency matrix serves as a valuable tool for ensuring coherence and rigour within a study such as this. This matrix systematically maps the interrelationships between various research components, including the aims, objectives, research questions, methods, data and contributions. By visually tabulating these connections, the matrix communicates the sustained internal alignment of the research process. This enables readers to identify potential misalignments or inconsistencies across different stages of the research process. A consistency matrix details evidence of the research's internal validity and logical flow, which in turn, strengthens the justification of the research presented (Choguill, 2005; Kaya & Bayram, 2021; Vargas-Bianchi & Arbaiza, 2022). Therefore, the research consistency matrix is an important instrument for demonstrating the integrity and congruity of a research process, and the ultimate success in the meeting of a study's goals. This is accordingly presented in Table 9.2 below.

Table 9.2: Consistency matrix detailing the alignment of the research aims, objectives, research questions, methods, data, and key contributions.

Aims	Objectives	Research Questions	Methods	Data	Key Contributions
To identify a suite of guiding tenets which inform the process of Africanising a tertiary soil science curriculum.	Review the existing academic literature on Africanisation and curriculum transformation, alongside interrogating the epistemologies of western soil science, and indigenous soil knowledges.	What does the existing academic literature indicate about the negative effects of euro-centric curricula and epistemic alienation in African universities, and the potential for Africanisation of curricula to address this?	Critical literature review.	Existing literature.	• Moral and practical motivations for Africanising curricula. • Identification and critique of western epistemic biases in the canon of soil science. • Discussion of the epistemic value of local soil knowledges.
		What does an analysis of the existing academic literature indicate about the tacit epistemics and biases of western and indigenous soil sciences?			
	Evaluate an undergraduate soil science textbook used in South African universities – in terms of its relevance to supporting teaching and learning in an African context.	To what extent does an ‘in-use’ undergraduate soil science textbook, prescribed in South Africa, support an Africanised soil science curriculum?	Critical textbook analysis.	Textbook.	• A critique of western textbooks as teaching aids.
	Design and enact a soil science curriculum, explicitly founded upon pedagogical theory for epistemic access as a step toward	What reflections, on a pedagogical-theory-informed teaching practice of a soil science curriculum, are useful to furthering Africanisation?	Reflective teaching praxis.	Teaching praxis.	• Initial steps in Africanising a soil science curriculum.

	Africanisation, and document the outcomes as a reflective learning practice.				• Theoretical action-reflection building-block.
	Conduct in-depth interviews with experts in the fields of curriculum transformation, soil science, and indigenous knowledge systems.	How do experts in soil science, curriculum transformation, and indigenous knowledge systems view the notion and practice of Africanisation within the context of teaching undergraduate soil science?	Interviewing and CGT memoing.	Interviews and memos.	• Transcripts and memos.
	Utilize constructivist grounded theory methods to code and analyse the data.	What tenets are meaningful and useful to pedagogues in Africanising a soil science curriculum?	Constructivist Grounded Theory.	Interviews. Memos. Reflective teaching praxis. Textbook analysis.	• Guiding tenets for advancing the Africanisation of a soil science curriculum.
	Distil a set of guiding tenets that support pedagogues in developing an Africanised undergraduate soil science curriculum.				
To produce a theory as to how a pedagogue may deeply engage in the process of meaningfully Africanising an undergraduate soil science curriculum.	Formulate a theory detailing a process of how a pedagogue may engage in meaningfully Africanising a soil science curriculum.	What process can pedagogues engage/adopt/trace/employ/undertake/explore in developing an Africanised undergraduate soil science curriculum?	Constructivist Grounded Theory.	Guiding tenets for advancing Africanisation	• CGT to advance the Africanisation of a soil science curriculum and Mode 2 knowledge.

9.3 Research Reflections

Reflective memoing is integral to GCT methodology, and has thus been an important practice in developing this study and the CGT produced. Thus, certain researcher reflections on this study were considered useful in their insights and deemed to further contribute to the epistemic depth and material contributions of the study. Accordingly, these are detailed in two categories below.

9.3.1 Reflections on the Research Process and Resistance to Epistemic Plurality

Regarding the phased approach to the CGT methodology: the initial phases of the study (Chapters 3 and 6) made for important researcher knowledge foundations from which to co-construct knowledge with interviewee participants. Without this initial scoping of the literature in the research areas, the CGT developed may have only gone as far as proposing integrating pedagogical theory for epistemic access, and the additive inclusion of IK examples (as trialled in Chapter 6). Nevertheless, due to the constructivist approach of the grounded theory, the researcher's existing knowledge is acknowledged and valued (Charmaz, 2006). Consequent synergies with participants were afforded, to further the theory building so as to extend 'beyond examples' to include broader visions of Africanising curricula, such as valuing plurality, dialogue and epistemic justice. Thus, ultimately, theoretical insights were deepened by initial researcher knowledge. Yet, they did not appreciably constrain the expanded CGT produced by acting as limiting pre-conceptions. Thus, diverse knowledge and experience was seen to forward theoretical conceptualisation of advancing Africanisation.

It could, and may well be argued however, that soil science is the domain of the 'science' of soil. That other disciplines and non-academics may talk about and discuss soils, but not define what soils are. Nonetheless, such territorial thinking limits the directions in which thinking about soils, both scientifically and otherwise, can be expanded. This is reminiscent of what occurred in the 1980s 'legitimation crisis' to the chagrin of soil scientists then (see Section 4.3). To the detriment of the then discipline, siloed understandings and investigations of soil physics, chemistry, and pedology neglected the broader environmental dimensions of soils (Brevik *et al.*, 2016). Subsequently however, environmental and sustainability considerations were heavily integrated into the discipline (Landa & Brevik, 2015; Francis & Tóth, 2022). Today, in an uncanny parallel, socially-located understandings of soils still remain on the fringe

of soil science; while practitioners in other disciplines advance understandings of soils in this regard (de la Bellacasa, 2019; Krzywoszynska, 2019; Salazar *et al.*, 2020; Sigl *et al.*, 2023).

Thus, today, a scientist could remain in adherence to their ‘known domain’, and claim that indigenous and students knowledge holders have a dilute, non-scientific (i.e. less meaningful) understanding of soils and their environment. Regardless, this remains an assumption – because they do not know what others know, they only assume it to be inferior to their scientific knowledge. This is because science has been touted as universally superior, which is a simplistic and unsupportable argument (see Chapter 2). Rather, this assumption of science’s superiority can usefully be interrogated and reflected upon by engaging in dialogue with others and other epistemics. Then, as many others have found – by a process of deep questioning, epistemic discomfort, and connection to the local context and people – value can be found in accommodating and synthesising a plurality of epistemics. Moreover, these other epistemics are inevitably qualitatively different from science. Accordingly, learnings from them may likely not be about quantitative content (e.g. measurable soil variables), but rather, about other useful and sustainable approaches to meaningfully thinking about soils. Thus, it behoves scientists, convinced of the superiority of their knowledge, to question its limitations and epistemic injustices.

There is ultimately no tick-box solution to this process-based epistemic transformation. That is to say, socially justice aims can clarify the desirable direction of transformation, but it does not supply each and every single step to achieve it. Rather, each limitation viewed as an affordance sheds light on the subsequent step. In other words, a destination is not reached without discovering the route, step by step. Moreover, no destination is final, and the way forward becomes apparent upon arriving at a previously aimed for goal. In other words, only once a successive factor is identified (made visible and understood) to be limiting of epistemically just transformation, can efforts be made to transcend it. It is thus through a process of reflective reconceptualization, and transcending epistemic discomfort (to epistemic expansion), that Africanisation is advanced. In the context of a soil science curriculum, the resulting personal and reflective process comes to embrace an equality of diverse epistemics. Consequently, scientific and other soil knowledges may be synergised for the benefit of African peoples. Such transformed understandings are important to propagate epistemically just Africanised teaching

and learning through the university and the discipline. Moreover, this approach can usefully extend to generating new epistemically just knowledge to re-shape the canon and contribute toward shifting the historical biases in the global soil science epistemic. If open to risking expanded epistemics and by engaging with the CGT process, this study provides a useful and implementable conceptual mechanism for advancing Africanisation of soil science curricula along such a route.

9.3.2 Reflections on Activities to Advance Africanisation of Soil Science Curricula

In engaging in the process of this study, reflections aided in developing a set of pointed epistemic questions to support the identification of hindrances to Africanisation in reviewing an academic's curricula. In answering these questions, pedagogues can identify affordances to overcome these hindrances and subsequently advance the Africanisation of their soil science curricula. The following questions are suggested as departure points:

- Whose knowledge is in the curriculum?
- Who generates the knowledge in the curriculum?
- Who controls the knowledge in the curriculum?
- Who is employed to develop and teach the curriculum?
- Who is funding the knowledge generation?
- Whose vested interests drive this knowledge generation?
- Why do these groups/people have power over the knowledge generation?
- For what purposes is the knowledge in the curriculum?
- What and whose knowledge is included? And whose knowledge is excluded?
- What knowledge is valid? What knowledge is invalidated?
- What pedagogies are employed?

Implementing further iterations of Africanisation (by way of further teaching praxis) are beyond the scope of this study. Nevertheless, reflecting on visions of Africanising curricula prompted the development of a practical list of activities and considerations, which may advance Africanisation of soil science curricula. The reflections that produced this list of activities arose from the Africanising process of this study, including discussions with participants, engaging with the literature, and reflective memoing. These synthesised activities are however, neither referenced, nor trialled. Thus, they only represent suggestions, based on documented reflections which emerged in the process of this study. These suggestions offer ideas and practices that can support the Africanising teaching praxis of other academics.

Reflecting on Self and Values:

- Academics can conduct a reflective exercise to interrogate and surface their own values. Subsequently they can list institutional/departmental values and interrogate the similarities and differences.
- Academics can reflect on their own learning journey to surface their motivations, biases and epistemic departure points.
- Academics can conduct an exercise in which they list at least ten things that they 'are' (e.g. scientist, parent, sport-enthusiast, etc.). Then they can reflect on the 'objective scientific' definitions of those, versus the socio-culturally connected meaning of those. This reflection can prompt an evaluation of different viewpoints, which can then be extended to others, and how different viewpoints on them are fundamentally meaningful.
- Academics can reflect that Africanisation and curriculum transformation begins with the 'self', where the lecturer becomes a facilitator, and is simultaneously open to learning in the process of facilitating the knowledge co-construction of students.
- Academics can reflect on notable instances where their own learning entailed epistemic discomfort, as moving from the known to the unknown necessitates epistemic expansion or growth, which can be challenging. Such a reflection can engender empathy toward students, which can in turn foster connection and respect for their learning stage and efforts.
- Academics can cultivate an openness toward other epistemics, by seeking to go beyond the 'right' or 'wrong' of science, and respect the truth of multiple knowledges of others.
- Academics can work to adopt a nurturing 'surfeit thinking' stance towards students and their knowledges, rather than negatively framed deficit thinking about their capabilities, as this only results in a 'self-fulfilling prophecy'.
- Academics can keep a reflective teaching journal, jotting down thoughts and/or spending five minutes at the end of the day reflecting on their teaching experiences and learnings.

Curriculum Design and Transformation:

- Academics can interrogate and deconstruct the values and assumptions (the hidden curriculum) embedded in the existing curriculum. Questions that can instigate this, include:
 - What do academics expect students to know? Why do academics expect them to know it? What knowledge and skills do academics deem 'important' and 'meaningful'? Why is that so? What are the curriculum's purposes? What are the academic's and the students' roles in the curriculum? Why is that so? Mirror this exercise for students.
- Academics can design a curriculum with more open-ended outcomes. Both the academic and the students can propose outcomes. Both academics and students can strive toward meeting the outcomes, at their respective learning stage. A guiding framework can be used, including suggestions such as:

- Defining outcomes beyond content, but also including content. Learning ways of thinking, including reflection. Openness to learning from others. Academics and students accepting responsibility for their meaningful engagement, learning, and responses toward each other.
- Academics can seek to prioritise the facilitation of learning skills over content in the curriculum. For example, synthesising multiple viewpoints (LSKs and scientific), problem-solving, critical thinking, team-work, dialogue, fruitfully engaging with the unknown and its epistemic discomfort and consequent growth, etc.
- Academics can seek to build process into a curriculum. Open, emergent outcomes are more congruent and applicable in real-world soil management. Similarly, when in the field, local contexts and stakeholders will seek respect, dialogue and experimentation in problem solving which results in successful outcomes.
- Academics can formally plan or build dialogue into the curriculum. Both with peers and with the academic. Consider what the enablers are that foster openness and engagement. For example, disagreement is allowed and respected. Similarly, what factors create a 'safe-space' for learning, where students are encouraged to be epistemically 'brave' in the face of the discomfort of learning, and are not fearful of being so 'wrong' that they are alienated, and shut down to learning.

Student Engagement and Reflection:

- Academics can present students, at the start of a course, with a reflective life-essay exercise. This assists the academic to know who their students are, and by knowing this, they can dynamically adapt the curriculum to the cohort. This asks them to very briefly describe:
 - Who are they? What are their values? What do they know/assume/expect about the university and discipline? Who are they, in relation to the subject? What do they want from learning about the subject?
- Academics can present students with regular reflective exercises, asking them to reflect on their learnings. This can assist the academic to remain dynamic to the students' progress. For students' construction of their knowledge to progress, they need to depart from the known, and facilitated into the not-yet-known. Thus academics are sensitised to students' knowledge as a point of connection.
- Academics can ask students to share a reflective exercise with their peer. This encourages dialogue between students, and can prompt learning and teaching between students.
- Academics can compare student life-essays and student reflections on the curriculum, with their own values and reflections on the curriculum. Accordingly they can:
 - Seek out similarities and differences. Seek areas of connection, and integrate these into a dynamic, fit for purpose, Africanised curriculum.
- Academics can present students with a 'university is not school' exercise. This is a problem-based or multi-modal learning exercise, appropriate to the discipline and curriculum, which, in their undertaking it:

- Demonstrates to students their habits of rote learning; demonstrates the shortfalls of rote learning; demonstrates critical thinking, and the advantages thereof.
- Academics can integrate group work into the curriculum which (communicated explicitly to students), seeks to:
 - Undermine competition and fosters cooperative skills and values of *ubuntu*.

Integrating Indigenous and Local Knowledge:

- Academics can integrate LSKs into the curriculum. This can be garnered from ethnopedological literature and connecting to knowledge holders of LSKs. Integration of LSKs into the curriculum should:
 - Focus on their knowledge (corpus), management practices (praxis) and beliefs (kosmos). This should go beyond additive examples and illustrate the value and differences of LSKs in their own right (and not solely as validated by science).
- Academics can devise a comparative exercise for students, in which:
 - Students are provided with a number of local African case studies (both LSK and soil science). These should focus on a common issue (e.g. soil erosion). Students are asked to relate what can be learned from these case studies, and to highlight the differences between the scientific and LSK approaches. Academics can facilitate the feedback of student knowledge. Subsequently provide students with foreign (non-African) cases, and students are asked to critically feedback how the localities are both different and similar.
 - The exercise can prompt students to make connections, identify differences, appreciate differing perspectives on the same issue, and think critically.
- Academics can introduce students to African cases of participatory soil management, which have increased the success of rural soil conservation. Students can feedback as to what aspects of the participatory process were key to the success.

Professional Development:

- Academics can engage with the literature (particularly review articles) on: Africanisation theory; the history and philosophy of science; scientism; pedagogics; science education; decolonial theory; ethnopedology; indigenous methodologies, problem-based learning etc. This can be done in with the support of reading and discussion groups. Further, engaging in such trans-disciplinary literature, can foster the development of new African knowledge, and produce research publications.

The forgoing suggestions can provide learnings and reflections that can sensitise academics to their own beliefs; their students' diverse ontologies and epistemologies; to their similarities and differences and can also prompt students to reflect on their learning, feel respected, and

think critically. Cultivating understanding of others' diverse epistemics requires active listening, curiosity, humility, and respecting diverse voices. Biases and epistemic departure points should also be acknowledged, to reflectively and fairly contextualise responses to encountering other epistemics. Thus, limitations, viewed as affordances, can promote epistemic exploration, while co-learning and interdependence can support transcending epistemic discomforts. Consequently, a recognition of shared humanity and diversity, empathy, and engaging in dialogue can be productive in bridging epistemic gaps and creating synergies. Such approaches can foster openness to epistemic plurality, enhance dialogue, increase mutual respect and consequent engagement, and can result in synergistic new knowledge. Such reflective and student-centred considerations are argued to advance the Africanisation of a soil science curriculum.

9.4 Reporting and Quality Criteria

Presenting a CGT is unlike various other qualitative approaches. Rather than the presentation of results and the discussion thereof, a CGT results in a cumulative theoretical synthesis (Charmaz, 2006). Accordingly, this requires a transparent and detailed account of the research process. Urquhart (2013) provides guidance on the appropriate and thorough reporting of a CGT. The write-up should clearly articulate the study's context, providing readers with an understanding of the environment in which the research was conducted. The coding procedure should be methodically represented, which demonstrates the analytical steps taken to move from raw data to conceptual categories. A clear chain of evidence, linking participant quotations (data) to codes and subsequent theoretical developments, is important in establishing the groundedness and credibility of the findings. Rich, descriptive findings should be presented, capturing the nuances of participants' perspectives. Researchers should also illustrate the relationships between codes (as grounded in the data), revealing the emergent theoretical structure. The substantive theory itself, the culmination of the analysis, should be clearly articulated, explaining the core concepts and their interrelationships. Lastly, the study should address theoretical integration, discussing how the emergent theory connects with existing literature and contributes to broader theoretical understanding, highlighting the researcher's co-constructed interpretations. Following from Urquhart (2013) a set of criteria for the well-organized reporting of a CGT, and how this study has met them, are provided in Table 9.3.

Table 9.3: Criteria apposite to the presentation of a CGT study (after Urquhart, 2013).

Criteria for presenting a CGT	Section in this study
Context of the study	Sections 6.2 and 7.2
Coding procedure	Section 5.4.2
Chain of evidence	Section 7.1 and 7.3
Rich narrative findings	Section 7.3
Relationships between codes	Section 7.3 and 8.2
Substantive theory	Sections 8.1, 8.2 and 8.3
Integration of literature	Sections 7.3 and 8.4

Beyond appropriate reporting, Glaser and Strauss (2006) advance quality criteria for specific application in grounded theory research (see Section 5.5). These quality criteria are: fit, grab, work, relevance, and modifiability. Reporting on quality criteria in a grounded theory study is important in demonstrating the thoroughness, robustness and utility of the emergent theory. This transparency allows readers to assess the theory’s credibility and its potential contribution to the field. These criteria demonstrate how the theory aligns with the data (fit), resonates with participants (grab), explains the phenomenon (work), addresses the research problem (relevance), and remains open to further refinement (modifiability). Consequently, evidence of the study’s trustworthiness and quality is established. Such reporting enables readers to evaluate the theory’s robustness and its potential to inform future research and practice (Olson & Raffanti, 2004; Charmaz, 2006; Glaser & Strauss, 2006:237-250; Holton, 2008; Bryant, 2014, Ralph *et al.*, 2014; Creswell, 2015; Devadas, 2017; Vander Linden & Palmieri, 2021). Table 9.4 below, defines these quality criteria, and details how this study has satisfied them.

Table 9.4: Evaluation of grounded theory quality criteria (after Glaser and Strauss, 2006).

Grounded theory quality criteria	Definition	Evaluation in this study
Fit	Checks if codes and categories emerged from the data itself, not pre-existing theories, ensuring the theory truly ‘fits’ and represents the data.	As detailed in Chapter 7, the thorough ‘chain of evidence’ (participant and page numbers) verifies that the theory emerged from, and represents, the data. Moreover, the in-depth literature reviews (Chapters 2 and 4) were written after the coding analysis, to diminish pre-conceptions manufacturing the CGT (see Section 1.6).
Grab	Evaluates how understandable and engaging the resulting theory is to academics in the field, i.e. its pragmatic clarity.	The unique diagrammatic clarity of the theory (Chapter 8), along with the guiding tenets (Chapter 7) are distilled to a degree such as to be both understandable and usable by academics wishing to engage in a meaningful process of Africanising their curricula.
Work	Assesses the theory’s ability to interpret, explain, and predict behaviour in relevant situations, i.e. its usefulness and explanatory power.	The theory predicts resistances, along with the efforts and changes which transcend them – as driven by reflexivity and concerns for epistemic justice. As it is a contextually grounded theory, its Africanising transformation is applicable and useful across a variety of environmental disciplines.
Relevance	Assesses the meaningfulness and applicability of the theory to the real-world context it seeks to explain.	The theory is both meaningful and applicable in the real-world, as it suggests definite directions (IKS, language, post-human) (see Section 8.2) in which academics may work toward Africanising their soil science curricula, while also providing a conceptual process to follow.
Modifiability	Evaluates the theory’s adaptable relevance over time, its ability to accommodate new research and data without becoming rigid.	The iterative process-based nature makes the proposed CGT very flexible. This means that it can be applied in a variety of contexts, by a variety of people, and a variety of meaningfully Africanised curricula may be produced – as the process is underpinned by the guiding tenets proposed but is not ridged and prescriptive of ‘soil science’-specific inputs or outcomes.

9.5 Limitations and Recommendations

As with all research methodologies, grounded theory is subject to certain limitations due to its specific approach. In particular, these have been argued to be the subjectivity of the researcher (Thornberg & Dunne, 2019); risk of ‘over-interpretation’ (Charmaz, 2006); inadequate sample sizes (Morse & Clark, 2019); complexity and resource intensiveness (Friese, 2019); a lack of standardised methods (Howitt, 2010), and limitations in generalisability (Urquhart, 2019). Each of these identified limitations are addressed in turn. This is followed by specific consideration of the contextual limitations of this research, and the resultant recommendations for further research.

While all researchers are subjective actors, this research has explicitly sought to account for this. Accordingly, the researcher’s epistemic departure points and worldviews were explicitly detailed (see Section 5.3). In addition to this, a detailed reporting of the coding procedure (see Section 5.4) and the ‘chain of evidence’ (see Section 7.3) allows readers to critically assess potential influences and fosters a more nuanced understanding of the research. Similarly, mitigating the risk of over-interpretation, or reading too much into the data, requires rigorous analysis. Key to this is the groundedness of the resultant CGT in the data. This study accordingly provided a scrupulous ‘chain of evidence’ (see Section 7.3), ensuring that the proposed CGT did meaningfully emerge from the data, its coding and memoing. Moreover, it can be problematic if a CGT’s sample is too small, as saturation may not be reached. This research however, while beginning with purposive and convenience sampling, was guided by initial coding to proceed to theoretical sampling. Thus, (as per Section 5.4.2), to ensure saturation, interviews were conducted until 30 hours, despite coding and memoing indicating saturation being met at approximately 25 hours. Likewise, the complexity and resource intensiveness (see Section 5.4.2) of grounded theory can undermine its thorough implementation. Nonetheless, an idiosyncratic, yet efficient, searchable and referenceable data and coding management method was devised for this study. This is for example allowed for thorough analysis as demonstrated in the meticulous ‘chain of evidence’ (see Section 7.3). While grounded theory offers a research framework, it is not prescriptive in method and specific implementations vary. The risk of obfuscating grounded theory analysis process, are accordingly mitigated by transparently reporting on the coding procedure (see Section 5.4 and Appendix 5.4). Lastly, due to its inductive nature, grounded in a specific set of participants, a study’s resultant grounded theory can struggle to be a generalizable theory. While the CGT

produced here is by no means a universalising theory, it is adequately abstracted beyond the discipline of soil science, to be reasonably applied in similar curricular contexts. As argued (see Section 8.2), other environmental science disciplines may feasibly utilise this study's CGT to advance Africanisation of curricula. In particular, disciplines with existing IK literature, such as ethnobotany, ethnozoology, ethnoecology, may be well positioned to effectively apply this study's CGT. Thus, these methodological limitations of CGT have been reasonably addressed by the aforementioned measures.

Specific limitations, attributed to the study and not the grounded theory methodology, were wholly attributable to the necessary constraints of scope. While this did enable an in-depth interrogation as to academics' views on Africanising curricula, it excluded the inclusion of associated but potentially relevant areas of inquiry. Primarily, student and LSK holder voices and perspectives on Africanising soil science curricula in the African university, were absent. Besides the constraint of scope however, academics were selected as the participants in this study for two key reasons. Firstly, they necessarily lead the implementation of transformation initiatives; while secondly, they are well positioned to be cognisant of curriculum transformation theory and imperatives. Accordingly, as this study's development of a CGT transformation process focused on the efforts of academics to advance Africanisation, their perspectives were prioritised. Another noteworthy limitation is the absence of directly interrogating African languages. Again, apart from scope constraints, while the researcher speaks seven languages, they are not African languages, and was consequently ill-equipped to meaningfully interrogate this factor of Africanisation. Nevertheless, African languages are identified by the research as an affordance for furthering Africanisation (see Section 8.1.2). Lastly, the CGT developed here, was specifically focused on an Africanising transformation of an undergraduate soil science curricula (again for reasons of a manageable scope). While it has been demonstrated that the theory was meaningfully theoretically abstracted, this may constrain the theory's applicability in other academic disciplines. Nevertheless, it has been argued here, that comparable environmental sciences may find the theory practicable.

Finally, recommendations for further study stem, in part, from these study-specific limitations. Ergo, it is first suggested that this CGT research can be extended to include the views and knowledges of students and LSK holders, and how they view and propose the meaningful

Africanisation of soil science curricula in the African university. For example, understandings of how to meaningfully connect to and dialogue with LSK holders beyond the university, so as to welcome their knowledge into the curriculum, is lacking. Such research may usefully modify this study's CGT from these additional perspectives. Importantly, as argued by this research, such integrations are required in Africanising soil science curricula; nonetheless, it remains to be seen as to how such integrations may be theorised. Furthermore, CGT research can usefully be conducted into *how* to meaningfully and equitably integrate African languages, into African university curricula, where the majority, but not all, students speak a variety of African languages. Such a process could usefully forward epistemic justice and the Africanisation of soil epistemics. Lastly, it is suggested that this study's CGT be practically trialled and critically reflected upon by academics who wish to Africanise their curricula in soil science. This could also be ventured in other comparable environmental science disciplines, or specific university contexts such as postgraduate supervision. This study demonstrated a starting point for Africanising soil science curricula, which in turn contributed to generating the study's ultimate CGT. To further advance Africanisation of curricula, future research could leverage this foundation by applying the proposed CGT; and consequently, documenting challenges and successful outcomes, so as to produce valuable Africanised insights.

9.6 Conclusion

This study set out to propose guiding tenets for Africanising a soil science curriculum, along with an accompanying process as to how soil scientists can meaningfully advance this transformation project. A CGT methodology was selected as effective in tackling this research problem. Initial researcher knowledge was developed by broad engagement with the literature, along with a critical analysis of a textbook and reflections on a preliminary Africanised teaching praxis. Subsequently interviews with academic experts in soil science, curriculum transformation, and IK were conducted. The transcripts thereof were analysed by grounded theory methods, such that iterative memoing and coding, produced progressively theoretically abstracted categories, grounded in the data. These categories comprised the guiding tenets for Africanisation and were discussed in light of existing literature. In depth literature reviews on Africanising curricula, epistemic biases in the soil science canon, and indigenous soil knowledges were also conducted. The forgoing was ultimately summatively synthesised into a process-based grounded theory for Africanising soil science curricula. The theory proffers that: by reflexive recognition of local limiting factors and injustices in these domains, the risk of

transcending limits is overcome and transformation for inclusion of African epistemai is spurred; the continued momentum of which is fuelled by a student-centred desire for epistemic and social justice, while resistances are fuelled by fears of the unknown and accompanying loss of western scientific certainty and control. Moreover, such an Africanised curriculum is proposed as a site for new, socially distributed, epistemically just, African knowledge generation. This is aligned with the Africanisation literature which advocates deconstructing of euro-centric epistemics, and the development of Africa-centred knowledges. This study accordingly addresses a significant gap in the development process of an Africanised soil science curriculum, and also advances the inclusion of new African knowledge in the canon of soil science.

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APPENDICES

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Appendix 4.1

A critical review of inherent universalist positivist perspectives in the IUSS's definitions of its commissions

A critical review of inherent universalist positivist perspectives in the IUSS's⁴⁵ definitions of its commissions.

Commission	Selection of commission definition	Inherent epistemic biases
1.1 Soil morphology and micromorphology	The morphogenetic properties that comprise soils are the essential elements of soil classification, interpretation, and land quality.	• Single genetic and deterministic view of soils.
1.2 Soil geography	Soil geography is the study of the soil cover and its many morphogenetic attributes as a function of climate, geology, relief, vegetation, human activities, and history.	• Single genetic and deterministic view of soils.
1.3. Soil Genesis	This Commission quantifies the fundamental physical, chemical, biological, and mineralogical processes (pedogenic) of gains, losses, translocations, and transformations occurring in soils from micro to macro scales to explain and understand profile formation.	• Quantitative genetic and deterministic view of soils.
1.4. Soil classification	[The] Commission [...] that categorizes the infinite number of morphogenetic attributes of the pedosphere so that the attributes used to classify soils permit the greatest number, most precise, and most significant statements about soil behavior and genesis. Classification systems are hierarchical so the knowledge base and interpretational inferences become more specific from the higher categories to lower ones. Classification allows scientists to communicate and share knowledge about the body.	• Quantitative precision valued. • Assumed definitiveness and significance of classification. • Hierarchical and universalist categorisations. • Assumed singularity of communication about soils.
1.5. Pedometrics	[T]he application of mathematical and statistical methods for the study [and modelling] of the distribution and genesis of soils.	• Positivist quantitative view of soils.
1.6. Paleopedology	The method is to compare the properties of dated paleosols and paleosol sequences with those of modern soils that are related to the known climate and other environmental factors as a proxy for interpreting past climatic and ecological changes and hence predicting soil changes over time.	• Principally quantitative methods.
2.1. Soil physics	Major research thrusts include modeling transport of inorganic, organic and microbial contaminants, fractal mathematics, spatial variability, geostatistics, computer-	• Principally quantitative methods.

⁴⁵ <https://www.iuss.org/commissions/> [Accessed 11 June 2024]

	assisted tomography, and remote sensing of soil physical properties.	
2.2. Soil chemistry	Major research thrusts include: application of molecular scale in-situ techniques to elucidate aqueous and surface chemical speciation and mechanisms, kinetics of soil chemical phenomena; rhizosphere chemistry; organic matter structure; and soil chemical modeling.	• Principally quantitative methods.
2.3. Soil biology	Major research thrusts are carbon sequestration, nutrient cycling, microbial ecology, bioremediation, and molecular soil biology.	• Principally quantitative methods.
2.4. Soil mineralogy	[P]romote modern approaches to soil mineralogy, such as data driven approaches, and especially those approaches that seek to advance understanding of the roles of soil minerals in relation to sustaining and enhancing the functions soils.	• Principally quantitative methods. • ‘Modern approaches’ are deemed quantitative. • Productivity of soils as a principle aim.
2.5. Soil chemical, physical and biological interfacial reactions	The Commission deals with abiotic and biotic interactive processes occurring in soil with the goal of advancing the understanding on physical/chemical/biological interfacial systems at the molecular to field/landscape levels.	• Positivist quantitative view of soils.
3.1. Soil evaluation and land use planning	[T]his Commission will encompass the broad activities of soil evaluation and land use planning and will include related activities of data gathering and management including remote sensing and Geographical Information Systems.	• Principally quantitative methods.
3.2. Soil and water conservation	In addition to the prevention of erosion by water and wind, this Commission will also concern itself with the efficient management of soil water through irrigation, drainage and the limitation of water loss from the soil surface.	• Productivity of soils as a principle aim.
3.3. Soil fertility and plant Nutrition	The management of soil fertility is a major activity of a substantial proportion of the world’s soil scientists.	• Productivity of soils as a principle aim.
3.4. Soil engineering and Technology	This Commission is concerned with engineering uses of soils both in the agriculture and non-agriculture context. Soils serve many purposes such as road beds and fill material, they are shaped and changed for many uses, used for filter fields, sewage and waste storage etc.	• Mechanistic and utilitarian view of soils.
3.5. Soil degradation control,	The purpose of this Commission is to use our knowledge and understanding of soil properties and processes to	• Productivity of soils as a principle aim.

remediation and reclamation	ensure that damaged/degraded soils may be remediated or reclaimed and returned to productive use.	
3.6. Salt-affected Soils	Processes of formation of salt-affected soils, temporal and spatial variation of salinity, modelling of irrigation under risk of salinization, management practices aimed to avoiding or mitigating soil salinization, basic research on chemistry/physics/biology of salt-affected soils, plant ecology of halophytes related to the soil properties, reuse of saline and drainage waters, are among the frequent topics discussed at the Commission meetings.	• Principally quantitative methods. • Productivity of soils as a principle aim.
3.7. Soils of Urban, Industrial, Traffic, Mining and Military Areas	The aims of this commission are to promote soil science in strongly anthropogenic areas, to create a community of scientists dedicated to urban soil issues, to stimulate multidisciplinary research, and to increase the impact of soil science in the decision-making.	• Productivity of soils as a principle aim.
4.1. Soils and the Environment	Human activities have a strong impact on the ecosystems and the soil and environment interactions in relation to humans are particularly important.	• Mechanistic and utilitarian view of soils.
4.2. Soils, food security, and human health	Among the concerns of this commission, there is the maintenance and conservation of agricultural land, the role of soils in a changing world in relationship to human health.	• Mechanistic and utilitarian view of soils. • Productivity of soils as a principle aim.
4.3. Soils and land use Change	Of interest to all are significant changes in land use, including the effects of urbanisation, forest conversion and productive land being allocated to other uses.	• Productivity of soils as a principle aim.
4.4. Soil education and public awareness	[d]eals with teaching methods and the development of soil scientists – but also how soil-related knowledge is presented to other interested parties, as well as the information provided to the public and related general public awareness. A well informed public is needed so that the importance of soils is understood by all.	• Western soil science deemed as the arbiter and dispenser of definitive soil science knowledge
4.5. History, philosophy, and sociology of soil science	This Commission deals with our past; it links the study of what has happened in history and how soils can be used to help explain the past changes. This Commission is not just a record of history but the use and understanding of soil information and its relationship to human development and history.	• Genetic and utilitarian view of soils.

Appendix 4.2

IUSS presidents and their countries: 1924-2026

Years	Country	Continent	President	Gender	Years in office (elections in May)	Continent	IUSS presidency: Years in Office by Continent
1924-1927	USA	N. America	J.G. Lipman	Male	3	European	28
1927-1930	Former USSR	Former USSR	K. Gedroiz	Male	3	N. American	23
1930-1935	UK	Europe	J. Russell	Male	5	Asian	18
1950	Netherlands	Europe	C.H. Edelman	Male	1	Former USSR	9
1950-1954	Belgium	Europe	R. Tavernier	Male	4	Australian	8
1954-1956	France	Europe	A. Oudin	Male	2	African	2
1956-1960	USA	N. America	R. Bradfield	Male	4	S. American	0
1960-1964	Romania	Europe	N.C. Cernescu	Male	4		
1964-1968	Australia	Australia	E.G. Hallsworth	Male	4		
1968-1974	Former USSR	Former USSR	V.A. Kovda	Male	6		
1974-1978	Canada	N. America	C.F. Bentley	Male	4		
1978-1982	India	Asia	J.S. Kanwar	Male	4		
1982-1986	Germany	Europe	K.H. Hartge	Male	4		
1986-1990	Japan	Asia	A. Tanaka	Male	4		
1990-1994	Mexico	N. America	A.A. Santelises	Male	4		
1994-1998	France	Europe	A. Ruellan	Male	4		
1998-2002	Tailand	Asia	S. Theerawong	Male	4		
2002-2006	USA	N. America	D.L. Sparks	Male	4		
2006-2010	Australia	Australia	R.S. Swift	Male	4		
2010-2014	Korea	Asia	J.E. Yang	Male	4		
2014-2016	Germany	Europe	R. Horn	Male	2		
2017-2018	USA	N. America	R. Lal	Male	2		
2019-2020	Japan	Asia	T. Kosaki	Male	2		
2021-2022	Mexico	N. America	L.B.R. Sánchez	Female	2		
2023-2024	Italy	Europe	E.A.C. Costantini	Male	2		
2025-2026	Nigeria	Africa	V.O. Chude	Male	2		
Total					88		

Appendix 4.3

IUSS office holders and their countries: 2002-2026

	2022-2026	2018-2022	2014-2018	2010-2014	2006-2010	2002-2006	Europe	Asia	N. America	Australia	S. America	Africa
Division 1 – Soils in Space and Time												
Chair	Canada	Hungary	Hungary	Germany	Canada	Canada	3	0	3	0	0	0
1st Vice Chair	China	UK	Brazil	Korea	Australia	USA	1	2	1	1	1	0
2nd Vice Chair	China	UK	Brazil	Korea	None	USA	1	2	1	0	1	0
Vice Chairperson Centennial	Italy	None	None	None	None	None	1	0	0	0	0	0
Commission 1.1 Soil morphology and micromorphology												
Chair	Italy	Italy	Spain	Spain	USA	Australia	4	0	1	1	0	0
Vice Chair	Hungary	Canada	Canada	France	Spain	Israel	3	1	2	0	0	0
2nd Vice Chair	None	None	None	None	None	USA	0	0	1	0	0	0
Commission 1.2 Soil geography												
Chair	Russia	Germany	Germany	Germany	USA	Germany	4	1	1	0	0	0
Vice Chair	Brasil	Russia	Spain	Spain	Italy	Spain	4	1	0	0	1	0
2nd Vice Chair	None	None	None	None	None	Philippines	0	1	0	0	0	0
Commission 1.3 Soil Genesis												
Chair	Hungary	Hungary	Japan	China	USA	Russia	2	3	1	0	0	0
Vice Chair	Japan	New Zealand	Russia	Poland	Russia	China	1	4	0	1	0	0
2nd Vice Chair	None	None	None	None	None	Spain	1	0	0	0	0	0
Commission 1.4 Soil Classification												
Chair	South Africa	USA	USA	USA	USA	USA	0	0	5	0	0	1
Vice Chair	Spain	India	Italy	Russia	Hungary	Argentina	3	2	0	0	1	0
2nd Vice Chair	None	None	None	None	None	Belgium	1	0	0	0	0	0
Commission 1.5 Pedometrics												
Chair	France	Netherlands	Australia	USA	UK	Netherlands	4	0	1	1	0	0
Vice Chair	Italy	France	China	Netherlands	Australia	USA	3	1	1	1	0	0
2nd Vice Chair	None	None	None	None	None	None	0	0	0	0	0	0

Commission 1.6 Paleopedology												
Chair	Russia	Russia	Germany	Germany	Italy	Italy	4	2	0	0	0	0
Vice Chair	Mexico	Mexico	Mexico	Mexico	Russia	Russia	0	2	0	0	4	0
2nd Vice Chair	None	None	None	None	None	Italy	1	0	0	0	0	0
Division 2 – Soil properties and processes												
Chair	Italy	Japan	Japan	Austria	Switzerland	Italy	4	2	0	0	0	0
1st Vice Chair	China	UK	Brazil	Korea	Australia	USA	1	2	1	1	1	0
2nd Vice Chair	China	New Zealand	Brazil	Korea	None	USA	0	2	1	1	1	0
Vice Chairperson Centennial	Italy	None	None	None	None	None	1	0	0	0	0	0
Commission 2.1 Soil physics												
Chair	Argentina	Germany	Germany	Switzerland	UK	Italy	5	0	0	0	1	0
Vice Chair	Poland	Hungary	Japan	China	USA	Belgium	3	2	1	0	0	0
2nd Vice Chair	None	None	None	None	None	New Zealand	0	0	0	1	0	0
Commission 2.2 Soil chemistry												
Chair	Belgium	Netherlands	UK	USA	Austria	Italy	5	0	1	0	0	0
Vice Chair	Netherlands	Belgium	Netherlands	Italy	Italy	Austria	6	0	0	0	0	0
2nd Vice Chair	None	None	None	None	None	Netherlands	1	0	0	0	0	0
Commission 2.3 Soil biology												
Chair	Spain	Germany	Germany	Japan	Italy	Australia	4	1	0	1	0	0
Vice Chair	Poland	Poland	Japan	Germany	Japan	Japan	3	3	0	0	0	0
2nd Vice Chair	None	None	None	None	None	USA	0	0	1	0	0	0
Commission 2.4 Soil mineralogy												
Chair	Russia	UK	Australia	USA	Australia	Australia	1	1	1	3	0	0
Vice Chair	Brazil	Russia	Scotland	Australia	Italy	USA	2	1	1	1	1	0
2nd Vice Chair	None	None	None	None	None	Italy	1	0	0	0	0	0

Commission 2.5 Soil chemical, physical and biological interfacial reactions												
Chair	Argentina	France	France	Italy	France	None	4	0	0	0	1	0
Vice Chair	Chile	China	China	France	Australia	None	1	2	0	1	1	0
2nd Vice Chair	None	None	None	None	None	None						
Division 3 Soil Use and Management												
Chair	China	Norway	Norway	Germany	Germany	Germany	5	1	0	0	0	0
1st Vice Chair	China	UK	Brazil	Korea	Australia	USA	1	2	1	1	1	0
2nd Vice Chair	None	UK	Brazil	Korea	None	USA	1	1	1	0	1	0
Vice Chairperson Centennial	Italy	None	None	None	None	None	1	0	0	0	0	0
Commission 3.1 Soil Evaluation and Land Use Planning												
Chair	India	Russia	Russia	Netherlands	Brazil	Brazil	1	3	0	0	2	0
Vice Chair	Japan	India	None	Hungary	Germany	Burkina Faso	2	2	0	0	0	1
2nd Vice Chair	None	None	None	None	None	Honduras	0	0	0	0	1	0
Commission 3.2 Soil and Water Conservation												
Chair	Norway	Norway	Germany	Netherlands	USA	USA	4	0	2	0	0	0
Vice Chair	Chile	Japan	China	Germany	Korea	Korea	1	4	0	0	1	0
2nd Vice Chair	None	None	None	None	None	Nicaragua	0	0	1	0	0	0
Commission 3.3 Soil Fertility and Plant Nutrition												
Chair	Argentina	Germany	Canada	Colombia	Syria	Syria	1	2	1	0	2	0
Vice Chair	Brazil	Japan	Japan	India	Australia	Colombia	0	3	0	1	2	0
2nd Vice Chair	None	None	None	None	None	USA	0	0	1	0	0	0

Commission 3.4 Soil Engineering and Technology												
Chair	China	China	China	Korea	Korea	Germany	1	5	0	0	0	0
Vice Chair	Japan	Romania	Romania	Germany	India	India	3	3	0	0	0	0
2nd Vice Chair	None	None	None	None	None	China	0	1	0	0	0	0
Commission 3.5 Soil Degradation, Control, Remediation and Reclamation												
Chair	Germany	Germany	Spain	Kenya	Australia	Australia	3	0	0	2	0	1
Vice Chair	Poland	Japan	China	Japan	New Zealand	Hungary	2	3	0	1	0	0
2nd Vice Chair	None	None	None	None	None	China	0	1	0	0	0	0
Commission 3.6 Salt Affected Soils												
Chair	Spain	Hungary	USA	USA	None	None	1	0	2	0	0	0
Vice Chair	India	South Korea	China	Hungary	None	None	1	2	0	0	0	0
Commission 3.7: Soils of Urban, Industrial, Traffic, Mining and Military Areas (SUITMA)												
Chair	Korea	None	None	None	None	None	0	1	0	0	0	0
Vice Chair	Poland	None	None	None	None	None	1	0	0	0	0	0
Division 4 The Role of Soils in Sustaining Society and the Environment												
Chair	Italy	Australia	France	USA	Australia	Switzerland	3	0	1	2	0	0
1st Vice Chair	China	UK	Brazil	Korea	Australia	USA	1	2	1	1	1	
2nd Vice Chair	China	UK	Brazil	Korea	None	USA	1	2	1	0	1	0
Vice Chairperson Centennial	Italy	None	None	None	None	None	1	0	0	0	0	0

Commission 4.1 Soils and the Environment												
Chair	Spain	Japan	Japan	India	New Zealand	Sweden	2	3	0	1	0	0
Vice Chair	Japan	Italy	Australia	New Zealand	New Zealand	USA	1	1	1	3	0	0
2nd Vice Chair	None	None	None	None	None	France	1	0	0	0	0	0
Commission 4.2 Soils, Food Security and Human Health												
Chair	Austria	Austria	USA	USA	USA	USA	2	0	4	0	0	0
Vice Chair	Japan	None	Austria	China	USA	Czech Republic	2	2	1	0	0	0
2nd Vice Chair	None	None	None	None	None	USA	0	0	1	0	0	0
Commission 4.3 Soils and Land Use Change												
Chair	USA	Australia	Japan	Japan	New Zealand	USA	0	2	2	2	0	0
Vice Chair	Chile	Germany, Japan	USA	Iran	Brazil	USA	1	2	2	0	2	0
2nd Vice Chair	None	None	None	None	None	Kenya	0	0	0	0	0	1
Commission 4.4 Soil Education and Public Awareness												
Chair	Colombia	Brazil	Australia	Australia	USA	France	1	0	1	2	2	0
Vice Chair	Venezuela	Japan	Brazil	China	USA	Australia	0	2	1	1	2	0
2nd Vice Chair	None	None	None	None	None	France	1	0	0	0	0	0
Commission 4.5 History, Philosophy, and Sociology of Soil Science												
Chair	Germany	USA	USA	Australia	USA	USA	1	0	4	1	0	0
Vice Chair	Germany	USA	Australia	USA	Madagascar	Israel	1	1	2	1	0	1
2nd Vice Chair	None	None	None	None	None	Netherlands	1	0	0	0	0	0
					Sum of Comissions		132	89	56	33	32	5

IUSS Working Groups officers												
Acide Sulphate Soils												
Chair	Finland	n/a	n/a	n/a	Australia	n/a	1	0	0	1	0	0
Vice Chair	Australia	n/a	n/a	n/a	Finland	n/a	1	0	0	1	0	0
Cryosols												
Chair	Russian	n/a	n/a	n/a	New Zealand	n/a	0	1	0	1	0	0
Vice Chair	None	n/a	n/a	n/a	None	n/a	0	0	0	0	0	0
Digital Soil Mapping												
Chair	Netherlands	n/a	n/a	n/a	Denmark	n/a	2	0	0	0	0	0
Vice Chair	None	n/a	n/a	n/a	None	n/a	0	0	0	0	0	0
Digital Soil Morphometrics												
Chair	USA	n/a	n/a	n/a	USA	n/a	0	0	2	0	0	0
Vice Chair	None	n/a	n/a	n/a	None	n/a	0	0	0	0	0	0
Forest soils												
Chair	Australia	n/a	n/a	n/a	Australia	n/a	0	0	0	2	0	0
Vice Chair	USA	n/a	n/a	n/a	USA	n/a	0	0	1	0	0	0
Global Soil Change												
Chair	n/a	n/a	n/a	n/a	USA	n/a	0	0	1	0	0	0
Vice Chair	n/a	n/a	n/a	n/a	USA	n/a	0	0	1	0	0	0
Heritage Soils												
Chair	n/a	n/a	n/a	n/a	UK	n/a	1	0	0	0	0	0
Vice Chair	n/a	n/a	n/a	n/a	Rep. of Moldova	n/a	1	0	0	0	0	0
Hydropedology												
Chair	Germany	n/a	n/a	n/a	USA	n/a	1	0	1	0	0	0
Vice Chair	South Africa	n/a	n/a	n/a	Germany	n/a	1	0	0	0	0	1
Land Degradation												
Chair	n/a	n/a	n/a	n/a	Norway	n/a	1	0	0	0	0	0
Vice Chair	n/a	n/a	n/a	n/a	USA	n/a	0	0	1	0	0	0
Modelling of Soil and Landscape Evolution												

Chair	n/a	n/a	n/a	n/a	Belgium	n/a	1	0	0	0	0	0
Vice Chair	n/a	n/a	n/a	n/a	Spain	n/a	1	0	0	0	0	0
Paddy Soils												
Chair	Japan	n/a	n/a	n/a	Japan	n/a	0	2	0	0	0	0
Vice Chair	Indonesia	n/a	n/a	n/a	UK	n/a	1	1	0	0	0	0
Proximal soil sensing												
Chair	Australia	n/a	n/a	n/a	Belgium	n/a	1	0	0	1	0	0
Vice Chair	Canada	n/a	n/a	n/a	Germany	n/a	1	0	1	0	0	0
Soil monitoring												
Chair	Australia	n/a	n/a	n/a	France	n/a	1	0	0	1	0	0
Vice Chair	UK	n/a	n/a	n/a	UK	n/a	2	0	0	0	0	0
Soil Information Standards												
Chair	Netherlands	n/a	n/a	n/a	Australia	n/a	1	0	0	1	0	0
Vice Chair	None	n/a	n/a	n/a	Germany	n/a	1	0	0	0	0	0
Soils of Urban, Industrial, Traffic, Mining and Military Areas (SUITMA)												
Chair	n/a	n/a	n/a	n/a	France	n/a	1	0	0	0	0	0
Vice Chair	n/a	n/a	n/a	n/a	China	n/a	0	1	0	0	0	0
Universal Soil Classification System												
Chair	Australia	n/a	n/a	n/a	USA	n/a	0	0	1	1	0	0
Vice Chair	USA	n/a	n/a	n/a	Italy	n/a	1	0	1	0	0	0
World Reference Base												
Chair	Poland	n/a	n/a	n/a	Germany	n/a	2	0	0	0	0	0
Vice Chair	Netherlands	n/a	n/a	n/a	South Africa	n/a	1	0	0	0	0	1
Global Soil Map												
Chair	France	n/a	n/a	n/a	n/a	n/a	1	0	0	0	0	0
Vice Chair	None	n/a	n/a	n/a	n/a	n/a	0	0	0	0	0	0
International Soil Modeling Consortium												

Chair	Netherlands	n/a	n/a	n/a	n/a	n/a	1	0	0	0	0	0
Vice Chair	USA	n/a	n/a	n/a	n/a	n/a	0	0	1	0	0	0
Cultural Patterns of Soil Understanding												
Chair	Germany	n/a	n/a	n/a	n/a	n/a	1	0	0	0	0	0
Vice Chair	USA	n/a	n/a	n/a	n/a	n/a	0	0	1	0	0	0
Young and Early Career Scientists												
Chair	Poland	n/a	n/a	n/a	n/a	n/a	1	0	0	0	0	0
Vice Chair	Mexico	n/a	n/a	n/a	n/a	n/a	0	0	0	0	1	0
					Sum of Working Groups		28	5	12	9	1	2

Appendix 4.4

Authors of *Soil Atlas of Africa* (2013): Photographs and affiliations

Authors of the 2013 <i>Soil Atlas of Africa</i>	Academic Affiliation	Photo of Author	Photo source [accessed 24 June 2024]
Olivier Dewitte	European Commission, Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy <i>and</i> Royal Museum for Central Africa, Department of Earth Sciences, Tervuren, Belgium		46
Arwyn Jones	Royal Museum for Central Africa, Department of Earth Sciences, Tervuren, Belgium		47
Otto Spaargaren	ISRIC – World Soil Information, Wageningen, The Netherlands		48
Henrik Breuning- Madsen	University of Copenhagen, Department of Geography and Geology, Copenhagen, Denmark		49

⁴⁶ <https://scholar.google.com/citations?user=1tPXzHoAAAAJ&hl=en>

⁴⁷ <https://www.youtube.com/watch?v=5k091uCtwKc>

⁴⁸ <http://www.soilbelgium.be/?cat=261>

⁴⁹ <https://www.tandfonline.com/doi/full/10.1080/00167223.2020.1771005>

Michel Brossard	Institut de Recherche pour le Développement (IRD), UMR Eco&Sols, Montpellier, France		50
Almami Dampha	African Union Commission, Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia		51
Jozef Deckers	University of Leuven, Department of Earth and Environmental Sciences, Heverlee, Belgium		52
Tahar Gallali	University of Tunis El Manar, Department of Geology, Tunis, Tunisia		53
Stephen Hallett	Cranfield University, National Soil Resources Institute, Cranfield, United Kingdom		54
Robert J.A. Jones	Cranfield University, National Soil Resources Institute, Cranfield, United Kingdom <i>and</i> European Commission- JRC, European Soil Bureau, Institute of Environment and Sustainability, Italy	None available	55 , 56

⁵⁰ https://www.youtube.com/watch?v=bLcIO_ZNato

⁵¹ <https://afstag-au.org/structure/>

⁵² <https://research.com/u/jozef-deckers>

⁵³ <https://kapitalis.com/tunisie/2022/08/25/deces-de-tahar-gallali-universitaire-chercheur-et-premier-dg-de-la-cite-des-sciences-de-tunis/>

⁵⁴ <https://www.cranfield.ac.uk/people/professor-stephen-hallett-786115>

⁵⁵ <https://www.semanticscholar.org/author/Robert-J.-A.-Jones/2213372103>

⁵⁶ <https://www.cranfield.ac.uk/people/Dr-Bob-Jones-22423649>

Method Kilasara	Sokoine University of Agriculture, Department of Soil Science, Morogoro, Tanzania	None available	57, 58
Pieter Le Roux	University of the Free State, Department Soil-, Crop- and Climate Sciences, Bloemfontein, South Africa		59
Erika Michéli	Szent István University, Department of Soil Science and Agricultural Chemistry, Godollo, Hungary		60
Luca Montanarella	European Commission, Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy		61
Lamourdia Thiombiano	Food and Agriculture Organization of the United Nations, Subregional Office for Central Africa, Libreville, Gabon		62

⁵⁷ <https://www.coa.sua.ac.tz/soil/previous-leader/>

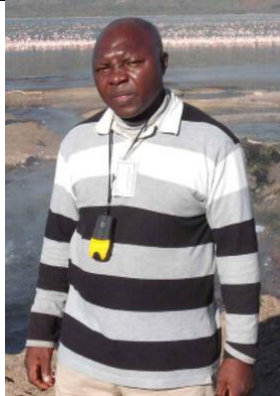
⁵⁸ <https://www.coa.sua.ac.tz/soil/method-kilasara/>

⁵⁹ <https://www.researchgate.net/profile/Pieter-Le-Roux-3>

⁶⁰ <https://www.researchgate.net/profile/Erika-Micheli>

⁶¹ <https://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/1334382/>

⁶² <https://www.researchgate.net/profile/Thiombiano-Lamourdia>

Eric Van Ranst	Ghent University, Department of Geology and Soil Science, Ghent, Belgium		63
Martin Yemefack	Institute of Agricultural Research for Development (IRAD), Department of Soil Water and Atmosphere Sciences, Yaoundé, Cameroon		64
Robert Zougmore	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), West and Central Africa, Niamey, Niger		65

⁶³ <https://www.researchgate.net/profile/Eric-Van-Ranst>

⁶⁴ <https://www.researchgate.net/profile/Martin-Yemefack>

⁶⁵ <https://www.researchgate.net/profile/Robert-Zougmore>

Appendix 4.5

Kosmos–Corpus–Praxis analysis of indigenous knowledge soil studies in South Africa

Kosmos–Corpus–Praxis analysis of IKS soil studies in South Africa

Authors	Year	Title	Study Area	Study Type: Kosmos–Corpus–Praxis
Critchley & Netshikvhela	1998	Land degradation in South Africa: Conventional views, changing paradigms and a tradition of soil conservation	Thononda, Vhembe district, Limpopo	- Corpus (soil classification, soil erosion & conservation) - Praxis (erosion management: stone terracing, grass strips, furrows, check dams; organic soil amendments)
Magoro & Masoga	2005	Aspects of indigenous knowledge and protection in small-scale farming systems: A challenge for advancement	Magatle community, Capricorn district, Limpopo	- Kosmos (ancestral meanings & traditional ownership of land parcels, agricultural rituals, astronomical signs) - Corpus (soil classification incl. fertility & workability) - Praxis (organic soil amendments, soil-crop pairings)
Materechera	2008	Indigenous knowledge and approaches of soil fertility management among small scale farmers in semi-arid areas of South Africa	Mafikeng, Ditsobotla, Ganyesa & Taung districts, North West	- Corpus (soil fertility, agroforestry) - Praxis (organic soil amendments, soil-tree pairings, fallowing, termite soils, earthworm castings)
Denison & Wotshela	2009	Indigenous water harvesting and conservation practices: Historical context, cases and implications	Guquka, Eastern Cape; and Gogela, KwaZulu-Natal	- Kosmos (astronomical signs) - Corpus (soil water management) - Praxis (soil preparation: gelesha; water & erosion management: stone terracing)
Nethononda & Odhiambo	2011	Indigenous soil knowledge relevant to crop production of smallholder farmers at Rambuda irrigation scheme, Vhembe District South Africa	Rambuda irrigation scheme, Vhembe district, Limpopo	- Corpus (soil classification, soil fertility) - Praxis (soil-crop pairings)
Buthelezi, Hughes & Modi	2013	The use of scientific and indigenous knowledge in agricultural land	Ezigeni &	Corpus (soil classification, soil fertility)

		evaluation and soil fertility studies of two villages in KwaZulu-Natal, South Africa	Ogagwini, KwaZulu-Natal	• Praxis (intercropping & rotation, soil-crop pairings, organic soil amendments & fallowing)
Rankoana	2017	The Use of Indigenous Knowledge in Subsistence Farming: Implications for Sustainable Agricultural Production in Dikgale Community in Limpopo Province, South Africa	Dikgale Community, Limpopo Province	• Kosmos (astronomical signs) • Corpus (soil classification, soil fertility) • Praxis (soil-crop pairings, organic soil amendments, fallowing)
Buthelezi-Dube, Hughes, Muchaonyerwa	2018	Indigenous soil classification in four villages of eastern South Africa	Khokhwane & Potshini, KwaZulu-Natal; and Ntshiqo & Zalaze, Eastern Cape	• Corpus (soil classification, soil fertility)
Buthelezi-Dube, Hughes, Muchaonyerwa, Caister & Modi	2019	Soil fertility assessment and management from the perspective of farmers in four villages of eastern South Africa	Khokhwane & Potshini, KwaZulu-Natal; and Ntshiqo & Zalaze, Eastern Cape	• Corpus (soil classification, soil fertility) • Praxis (organic soil amendments, soil-crop pairings)
Manyevere, Mnkeni, Laker & Muchaonyerwa	2020	The use of indigenous knowledge systems in soil classification, appraisal and soil productivity rating for maize cropping: a case of the Xhosa speaking people in Raymond Mhlaba municipality, South Africa	Middledrift, Raymond Mhlaba municipality, Eastern Cape	• Corpus (soil classification, soil fertility & erosion)
Ekobi, Mboh, & Tanga	2023	Contribution of indigenous knowledge to agricultural growth in South Africa: A case of Disaneng community in the Ratlou local municipality	Disaneng community, Ratlou municipality, North West	• Corpus (soil fertility) • Praxis (soil preparation & organic soil amendments, soil-crop pairings)

Appendix 5.1

Simplified categorisation of research paradigms

Simplified⁶⁶ categorisation of research paradigms (adapted from Blaikie, 2000:233; Bloor & Wood, 2006:18; Kackenzie & Knipe, 2006:5; Taylor & Medina, 2011; Shah & Al-Bargi, 2013:255, Moon & Blackman, 2014:3; Rehman & Alharthi, 2016:56; Denzin & Lincoln, 2017:195; Makombe, 2017: 3367-8; Okesina, 2020:66).

Ontology	<i>Realism</i> : One reality exists		<i>Relativism</i> : multiple realities exist				
Epistemology	<i>Objectivism</i> : truth (meaning) rests in the object which is independent from the observer (subject).		<i>Constructionism</i> : meaning is constructed between the interplay between object and subject.				
			<i>Subjectivism</i> : the subject contains all meaning and imposes all meaning on the object.				
Axiology	Knowledge generation is <i>value-free</i> e.g. beneficent approach. Research aims to maximise benefits. Position of objective detachment. Bias limitation.		Knowledge generation is <i>value-laden</i> e.g. balanced approach. Reporting of research aims to be balanced. Research is subjective and interactive. Blurred distinction between researcher and researched. Participants can be co- researchers. Researcher can be immersed. Integration of knowledge and values. Disclose bias. Utilize insight and intuition.				
Theoretical Perspective	<i>Positivism</i> : truth is inalienable and simply remains to be revealed.	<i>Post-positivism</i> : truth is inalienable, but not all truth may be revealed.	<i>(Social) Constructivism</i> : Meaning making of reality is an activity of the individual mind (within community).	<i>Interpretivism</i> : Interpretations of reality are culturally derived and historically situated.	<i>Critical Theory</i> : Research and theory should be used to change unequal power relations.	<i>Post-Modernism</i> : Truth claims are socially constructed to serve the interests of particular groups; methods are equally distrusted.	<i>Pragmatism</i> : All and any research approaches should be used to address a research problem.

⁶⁶ While this table attempts to provide a neat summary, in the study of research design, the academic literature is less than definitive on the definitions of the terminologies and the structural relations between them (Mackenzie & Knipe, 2006; Ruto-Korir & Lubbe, 2010; Shah & Al-Bargi, 2013; Denzin & Lincoln, 2017; Kivunja & Kuyini, 2017; Oberheim & Hoyningen-Huene, 2018; Nguyen, 2019; Okesina, 2020).

Methodology	<i>A deductive and quantitative strategy, such as:</i> Experimental, Quasi-Experimental, Correlational, Reductionism, Theory Verification, Causal Comparative, Randomised Control Trials, Determination, Case control, Case study, Cohort, Cross-section, Exploratory, Longitudinal, Observational, Sequential.	<i>An inductive and qualitative strategy, such as:</i> Hermeneutics, Dialectics, Phenomenology, Grounded Theory, Ethnography, Auto-Ethnography, Case Study (Single/Multiple), Historical and Documentary Research and Ethno-Methodology, Transformative Methodologies, Ideology Critique, Action Research, Descriptive, Narrative, Phenomenology, Exploratory, Historical (life/topical oral), Observational (participant/non-participant), Feminist theory, Neo-Marxist, Cultural Studies, Disability Theories, Queer Theory, Critical Race Theory, Participatory-Inquiry, Ideology-Critique, Emancipatory, Decolonial Methodologies, Southern Theory.	<i>A mixed-methods strategy, wherein:</i> A ‘triangulation’ of qualitative and quantitative methodologies is used to best address the research problem.
Methods (data collection techniques)	Experiments, Quasi- Experiments, Standardised Tests, Scales, Questionnaires, Closed-Ended Questionnaires, Structured Interviews, Descriptions of Phenomena Employing Standardised Observation Tools.	Observation (Participant / Non-Participant), Open-Ended Questionnaires, Interviews (Semi-Structured / In-Depth / Unstructured / Interactive), Focus-Groups, Life History, Think-Aloud Protocol and Role-Playing, Content Analysis, Document Analysis, Photographic/Visual Data Analysis, Performance Art Inquiry, Journaling.	A ‘triangulated’ combination of qualitative and quantitative methods.

Appendix 5.2

Interview schedules for disciplinary experts

Interview Schedule for Experts in Curriculum Transformation

1. What made you want to study/research/teach curriculum transformation?
2. How would you define curriculum transformation?
3. What are your view/s on calls to Africanise tertiary curricula?
4. Do you think scientific subjects can be Africanised?
5. How do you suggest scientists could engage in curriculum transformation?
6. What principles would you seek to apply to Africanise a scientific curriculum?
7. What practical steps would you suggest in Africanising a scientific curriculum?
8. In your experience, do scientists engaged with curriculum transformation and other pedagogical practices?
9. Demographic questions:
 - a. How many years in research/teaching at tertiary level
 - b. Highest qualification & year obtained & institution
 - c. Fe/male/other
 - d. Age group
 - e. Race
10. Can you please recommend any fellow South African curriculum transformation experts whom I may interview?
11. Do you have anything else pertinent to add?

Interview Schedule for Experts in both Curriculum Transformation and Indigenous Knowledge Systems

1. What made you want to study/research/teach curriculum transformation and/or IKS?
2. How would you define curriculum transformation?
3. How would you define IKS?
4. What are your view/s on calls to Africanise tertiary curricula?
5. How do you suggest scientists should be engaged to appreciate the importance of IKS?
6. Do you think scientific subjects can be Africanised?
7. How do you suggest scientists could engage in curriculum transformation?
8. What principles would you seek to apply to Africanise a scientific curriculum?
9. What practical steps would you suggest in Africanising a scientific curriculum?
10. In your experience, do scientists engaged with curriculum transformation and other pedagogical practices?
11. Demographic questions:
 - a. How many years in research/teaching at tertiary level
 - b. Highest qualification & year obtained & institution
 - c. Fe/male/other
 - d. Age group
 - e. Race
12. Can you please recommend any fellow South African curriculum transformation experts whom I may interview?
1. Do you have anything else pertinent to add?

Interview Schedule for Experts in Indigenous Knowledge Systems/Africanisation

1. What made you want to study/research/teach IKS?
2. How would you define IKS?
3. What are your view/s on calls to Africanise all tertiary curricula?
4. Do you think scientific subjects can be Africanised?
5. How do you suggest scientists should be engaged to appreciate the importance of IKS?
6. What principles would you seek to apply to Africanise a scientific curriculum?
7. What practical steps would you suggest in Africanising a scientific curriculum?
8. Demographic questions:
 - a. How many years in research/teaching at tertiary level
 - b. Highest qualification & year obtained & institution
 - c. Fe/male/other
 - d. Age group
 - e. Race.
9. Can you please recommend any fellow South African IKS experts whom I may interview?
10. Do you have anything else pertinent to add?

Interview Schedule for Experts in Soil Science

1. What made you want to become a soil science professional?
2. How did you end up teaching soil science?
3. What soil science modules do you teach? And at which undergraduate level/s?
 - a. How long is the module?
 - b. How many students in the module?
4. Please list the major sections of your undergraduate soil science curricula?
5. Did you generate this curriculum from scratch, or inherit it? Expand.
6. What is the assessment structure of your soil science modules?
7. What challenges do you have around assessment?
8. What pedagogical interventions/support do you have for underprepared undergrad students?
9. What soil science text book/s do you prescribe to undergraduates? (year of study & textbook name) (both prescribed & recommended list)
10. Did you inherit or choose this textbook? Expand. (Reasons for choice , pros & cons of book etc.)
11. Does your undergraduate soil science curriculum include any soil IKS content?
 - a. If yes, what content? And how much as a proportion of the curriculum?
 - b. If no, why have you decided this?
12. Are you aware of calls to Africanise tertiary curricula? What are your views?
13. How can scientific subjects such as soil science be Africanised? Expand.
14. Have you attempted to Africanise your soil science curriculum?
15. If you are forced to Africanise your soil science curriculum:
 - a. What aspects would you consider?
 - b. How would you proceed?
16. Are you familiar with the field of Ethnopedology?

- a. If yes, do you include it in curricula at undergraduate level?
 - b. What do you (and your students) find valuable in it?
- 17. What soil science practicals do you conduct?
 - a. Do you think these can be/have these been Africanised?
- 18. Demographic questions:
 - a. How many years teaching soil science at tertiary level
 - b. Highest qualification & year obtained & institution
 - c. Any educational/other qualifications?
 - d. Fe/male/other
 - e. Age group
 - f. Race
- 19. Can you please recommend any fellow South African soil scientists whom I may interview?
- 20. Is it possible to please send me the course outlines of your undergrad soil science modules?
- 21. Do you have anything else pertinent to add?

Appendix 5.3

Sample transcript of interview with Participant 19

Participant #19 – Transcribed Interview

MM: Question one, what made you want to study, research, teach curriculum transformation and or IKS?

P19: Um, well, one of the reasons is, you know you I deal with a lot of African students... so right through from undergraduate to postgraduate, the majority of the students that I teach in class, and supervise at first graduate levels are African students... and so one gets to see their performance and, you know, and when you deliver content to them, how they receive it actually makes one to wonder if they understand the concepts that you're teaching, you know... so you can see responses when you deliver a Eurocentric sort of like content as compared to a more indigenised content... the way they take in concepts... you can see that they... it impact the way they understand whatever that you're teaching them... so these are, you know, that's one of the reasons why I decided to, you know, take on this type of content and just to embark on this journey of exploring around IKS and the curriculum, yeah...

MM: I definitely hear that... you can very much see the impact in the classroom

P19: Yeah, yeah also with the level of engagement... one can pick up if the information is being processed or kind of like being rejected in a way without actually speaking, without getting verbal feedback from the students by the facial expressions and how they respond to your questions and all of that... and also in the written format, it does come out in their writing, yeah

MM: And you find they're more engaged with indigenised localised content?

P19: Yes, yeah... so if I try to explain a westernised science using indigenised examples and indigenised way of delivering content, they seem to be much more open... they ask questions, and they become much more curious because it looks like it's something that they can identify with, you know, for example, when I deliver content around fermentation, for example, you know... fermentation is a science concept that you can pull out a westernised way of teaching it and use a much more Eurocentric approach, but if you bring it back to the indigenous way of creating beer, for example... the fermentation process is still the same, but if you use an example of using, for example, *Umqombothi*, it's an African beer, you know, but fermentation... the fermentation process is the same... and so when you bring up...

MM: Yeah

P19: ...that aspect that is something that they can identify with because it's something that they've experienced in their own lives, you know, as African students, yeah... so they seem to be much more open and now they want to even learn more of what you're teaching...

P19: So, it increases engagement and interest when experiences linked to their own knowledge and their identity

P19: Exactly, yeah

MM: Perfect, question two then is, how would you define curriculum transformation?

P19: Um, how I define it is basically indigenising the curriculum, you know... I don't think you can decolonise it, but you can definitely indigenise it, you know... you know some science concepts that do exist within the African context... the difference is the African context has not been documented, you know, it's embedded in the cultures, you know, in African culture and how people relate as Africans, you know... it's lived experience, you know... so the westernised culture, it's much more, you know, documented, that is why it's easy to put it within the curriculum, you know, so with, yeah, so, how I see it is you can actually indigenise it... that's how I define (laughs) transformation of the curriculum... it's indigenising it, yeah.

MM: Okay...

P19: Yeah

MM: ...okay...

[5:00]

MM: ...I just wanted to dig in there a little bit more... how do you mean you can't decolonise the curriculum but you can indigenise it?

P19: Yeah, so we can't completely get rid of certain types of concepts that are Eurocentric, you know, you can actually create a bridge between the two... you know, like I said, there are things like... well, I specialize in medicinal plants, you know, and the Assam plants that are used to treat certain ailments, you know, but the problem is, in an African way of doing it, things are

not documented, however, when it comes to the westernised science, things have to be tested, you know, in the laboratory set up, you know... in the African way of doing things, things are not being put in the laboratory set up, but there are tests that are happening there... so, you see, the two cultures, the westernised culture, and African culture are using similar things... so, it could be the same plant, you know, treating the same thing... but then in terms of what gets to be incorporated in the curriculum is only the westernised format or the Westerner's way of doing things, you know, so that is why you can't completely sort of like decolonise the curriculum, but you can indigenise it... so you need to create a bridge between the two, yeah...

MM: I like what you say about the bridge... and I think underlying in there speaks very much about the validity and problematic superiority of Western culture around knowledge that those ways of doing things are valid.

P19: Yeah, exactly... yeah, yeah

MM: How would you then define IKS?

P19: IKS, indigenous knowledge systems, you know, the moment there's a word system, it means there's network, you know, it's a system... there are components that make these... several components work together, you know, so, it's a knowledge that encompasses culture, behaviour, beliefs, you know, language, you know, those are like examples, you know, so those things, they actually form a system... and they all emanate through knowledge... so it's what people know, you know, and the knowledge gets to be transferred from one generation to another through different practices and customs, you know, and beliefs and the way people raise children... it has to do with values, you know, the value system you know, and identity, you know, so indigenous knowledge system is a functioning system within the indigenous setup, which is made up of different you know, parts, like I've mentioned, it's a, you know... practices, customs, beliefs and values and all of that yeah... so I'm not sure if my definition is clear (laughs) yeah...

MM: No it's great...

P19: Yeah

MM: ...it's great... I very much like how you've broken up the components of the system's practices, culture, behaviour, beliefs, language, value systems, identity... anything else you'd add to that?

P19: Yeah, I think those are pretty much the key points and those key points can be broken down further into, you know, sub key points, you know...

MM: Of course

P19: ...yeah, so for example, in terms of the value system, you know, that the African culture is normally seen as patriarchal but that's not necessarily the case... I can give you an example, when a marriage has to happen between two people, normally, women are the ones that lead that type of negotiation when a person needs to get married (laughs)... the women are the ones that have to test the family of the groom, you know, in terms of their worthiness and their stability on how they do things, you know, in order to protect their daughter before they release their daughter to the family... so that has to do with family values, you know, and those values are based on success and an African way success is...

[10:00]

P19: ...based on the unity of the family, you know, how everyone understands their role in the family, you know, so there's the role of the father, the role of the mother and the kids and the elements of respect... for example, in an African context, when, when you're a woman and you speak to someone who's an elder in your family, who's a man, you don't look directly in their eyes (laughs), that's a sign of respect, you know...

MM: Sure

P19: ...so those are the value systems... so in that context, that process is led by women, not by men (laughs) you know...

MM: No, I understand

P19: ...yes, yes, yeah...

MM: That's a great example...

P19: Yeah

MM: ...and I think when you said, patriarchal, you mean paternalistic or...

P19: Well patriartic...

MM: You said African cultures often viewed as patriartic...

P19: Yeah, yes, yes.... like men are the ones that, you know...

MM: Yeah

P19: ...rule... like the ones that make the rules and all of that, but that's actually not necessarily the case... when you look deep into the IKS, in terms of how things are done, you see that women actually take a bigger role in decision making, yeah... they're just not vocal... so men are the one that presents the ideas that come from women (laughs)

MM: (Laughs)

P19: (Laughs), yes, yes...

MM: Yeah, no system is perfect, right?

P19: Yeah, you know, so yeah...

MM: So then, what are your views on the calls to Africanise tertiary curriculum?

P19: What are my views? Um, well, I think it is necessary to Africanise curriculum... because when... you see, the ability of, you know, to build a nation... when you build a nation, it's... you get people that through the curriculum... you know, you have to get education to become somebody, you know, that is recognized and a citizen that is responsible, you know, that contributes to the community... that contributes to the economy, you know... and you know, through my experience of sitting in interview panels, where we would interview a candidate for a particular position... one of the things that the panel's would gravitate on, it's not necessarily their CV... they know that the CV's got the qualifications... for the person who applied meets the required qualifications, right and the skill but I've seen that the panel would want to see the person's behaviour, you know... are they going to get along with other people, you know... how they handle themselves under pressure, things like that... and that has to do with behaviour, you know, and how a person carries themselves... so most interpersonal skills, you see what I mean... and those things are not taught by employers, those things you learn them from home (laughs)... they have to do with the value system that you get from home, on how you treat other people in the workplace... you see, that's why you get cases like bullying and all of that in the workplace... it's the behaviour of people (laughs)... and that can actually...

MM: No, I hear you

P19: ...yeah, you know, it affects how the system works within the corporate world, you know, so I think it is important to, you know, consider Africanising the curriculum because then it means you're going to bring in those elements from the indigenous knowledge systems and reemphasize the importance of certain customs and behaviours and, you know...

MM: And values

P19: Yes and values... so when a child is raised under that and they hear it in the classroom, that it's important to respect to elders, it's important to be polite, you know what I mean... to be respectful and they carry those skills with them, wherever they go, you know, so there is a level of contribution towards you know, what we foresee in the future, yeah...

MM: And so, I think you're saying that the contribution of IKS is a wider set of knowing things around value, responsibility, inter-personality, which, you know, often the literature speaks of bringing *ubuntu* into the curriculum and would you feel that content, IKS content, beyond examples could be brought into the curriculum?

P19: Yes, absolutely, yeah... they can be brought in, you know...

[15:00]

P19: ...beyond examples, yeah most definitely yeah... so, yes, yes...

MM: So that ties nicely into question five is, how do you then suggest that scientists should be engaged to appreciate the importance of IKS? How do we engage with scientists to...

P19: Hmmm, yeah, I think with science... with scientists, normally you look for... because I'm a scientist, too... so you know, the first thing that I look for is value, you know, what value do I get out of doing this type of work as a scientist, you know, so the first level of engagement is showing the sciences the value that they're going to get out of engaging with IKS stuff... you know, the importance of it and what contribution will IKS bring in their space... you see what I mean? Because there's a lot

of work ethic that goes in being a scientist, there's integrity, you know, for someone to actually conduct work, or an experiment and not forge results (laughs)... it takes someone with integrity...

MM: No sure...

P19: ...you know, honesty (laughs), you see what I mean... because if you're a scientist, you can present something in the world and say, I've achieved this but you've actually forged your results... you didn't do the lab work because no one monitors you in the lab (laughs)... no one comes and stands with you next to that machine to make sure that you record the right results... so honesty...

MM: So what...

P19: ...yeah...

MM: Hmmm?

P19: ...yes, yes...

MM: ...you were going to say?

P19: ...yes, so you see it's bringing up the values that would contribute towards advancement of science in many ways...

MM: Could you name some of those values?

P19: Okay, so besides contributing to as, you know, an integrity as a scientist is broadening the knowledge with some materials that are used in the indigenous world into science and to help make some questions or gaps make sense using the indigenous way of doing things because in science, there's a lot of questions... there's a lot of gaps... there are things which cannot be understood, you see what I mean... for example, in my area of study, we can produce a drug to treat a certain ailment, but you find that it's not effective over time, like antibiotics... sometimes you find that they work and then sometimes they don't work, you see... so to bridge those gaps, there are some knowledge... there is knowledge in the indigenous world system that can be incorporated into science to answer some science based questions... so that can add more value and fill some gaps by combining the two, yeah...

MM: So you've listed, IKS can bring essentially the softer skills around integrity to science, as well as content in broadening knowledge, anything else in particular?

P19: Um, well, it's quite broad, I think because I'm speaking from my...

MM: Of course

P19: ...area of science... with regards to IKS...

MM: It's exactly the opinion I'm looking for...

P19: ...yeah (laughs)... so there are other areas besides for example, in health, like the example that I've just used here... I don't know, like in areas, like in business and politics, you know, engineering as well, you know, because before colonisation, there was a functional system, you know, that was existing before colonisation, you know... people might have, you know, living... might have been living in mud houses, but for the fact that you can get into a mud house without an air conditioner and the house is so cool... I know my grandmother has one and in a very hot day would stay in that mud house without an aircon, but it will be so cool inside, you know (laughs)... there has to be some form of knowledge or intelligence (laughs) you know, in terms of constructing...

MM: And that ties into...

P19: Yes

MM: ...and that ties into sustainability because it's not using electricity.

P19: Exactly, you know, and conservation as well... and the use of certain types of materials to construct buildings and not use chemicals that are harmful, that are being used nowadays to construct buildings and people inhaling the dust and all of that from the cement... the type of cement that is being used and all of that... so it can contribute in many ways in the curriculum and the teaching, yeah

[20:00]

MM: So then, how is it do you think scientific subjects can be Africanised?

P19: Can you repeat the question?

MM: So, sorry, just to give you a little bit of context... the questions, sort of will keep spiralling to a little bit more detail and we'll probably cover some things that we've already covered, but I'm just looking to dig a bit deeper...

P19: Okay

MM: So the question is um... sorry, where were we... I've confused things here... no, we've asked that question... do you think scientific subjects can be Africanised? You said yes... and then question seven is how do you suggest... sorry I'm actually confusing things here... How do you suggest scientists could engage in curriculum transformation?

P19: Okay, how scientists could engage in curriculum transformation... um, firstly, they must be open to it (laughs)... they must be open to learning some things especially if they're not coming or they haven't been brought up under indigenous knowledge systems within the African context... they need to be open, you know to it... and if some scientists have actually been raised under the IKS system, they need to firstly appreciate it, you know, and value it... because we do have people who are Africans and who grew up here in Africa, but then they sort of like lost the sense, you know, the value of IK and they now prefer a Eurocentric way of doing things or westernised... and so they're losing the knowledge, you know... so firstly, they must now appreciate it and the other group must be open to it, that would be the first step, you know... because then they'll get to understand how it functions... they will understand the purpose and the values of it, and then from there, they'll be able to now incorporate certain parts of it into what they do as scientists, yeah...

MM: Sorry, I think very importantly you say they must be open to learning and the other side of that is be open to not knowing everything

P19: Yeah, yeah, exactly

MM: Okay, question eight then is, so what principles would you seek to apply to Africanise a scientific curriculum? If we speak about principles?

P19: Okay, um, I think principles would be... one of them would be respect, you know... the moment you respect a certain systems and a certain way of how other people do things outside your own world... outside your world view, you know... things become easier to collaborate and to engage, you know, if there is no respect then it becomes problematic, you know...

MM: Yeah

P19: Yeah, so if people respect IKS within the African context, you know, then it will make it easier to start the conversations... to make it easier to engage at deeper levels in terms of the curriculum, you know... so things flow easier in that particular way, yeah...

MM: Yeah, because you're not negating someone else's knowledge.

P19: Yes, and you're not seeing your knowledge as superior to them, you actually respect, you know, what they do (laughs) and then you open yourself to wanting to learn and for them to actually learn from your perspective as well, yeah

MM: Okay that's great and any other principles?

P19: Any other principles? Okay, I can't think of any right now (laughs)

MM: That's okay, we can come back to it...

P19: Yes

MM: ...if something arises...

P19: ...I think something might pop in my mind, yes, yeah

MM: That's okay, sorry, question nine then is...

[25:00]

MM: ...what practical steps would you suggest an Africanising a scientific curriculum?

P19: Okay, practical steps is, you know, there's got to be an opportunity for people to learn, you know... and when you encourage people to learn, you find spaces where the learning can happen, you know, so there are already spaces that exist... for example, you've got teachers in primary and high school spaces, you know... so that's a good place to start... to start with teachers because they get to teach the learners so incorporating some of the IKS things in the teaching in terms of the practice in the classroom, that will be a good start, you know... as well as in the university spaces, you've got lecturers, you've got

professors and you know, people that spend in front of the classroom... so, you know, putting that into the performance assessment, you know...

MM: Okay

P19: ...putting together workshops where people can learn how they can incorporate IKS when they are developing the curriculum, you know... so that would actually have a direct impact and a direct impartation of knowledge in IKS based concepts... you know, that's a good start, you know...

MM: Yeah

P19: ...um, other than that is to, you know, use other spaces like social media... and social media and broadcasting... so what people spend time on? They spend time on social media, they spend time on watching TV, for example, you know, that's where can be concertized and if they see something there, they can actually begin to open up, you know... and those things can be easily implemented... the content that has been broadcasted on TV, you know, if some of the content has got strategically designed in such a way that it promotes IKS that can work, you know, yeah... so I think those are the...

MM: Those are some great practical steps

P19: Yes, yes, yeah, using the already existing systems that are already in place as a vehicle, yeah

MM: Sorry, I'm just taking some notes

Appendix 5.4

Focused and Theoretical coding analysis

Interview	Question Set	Q	P	Focused Codes (Level 2A)	Focused Codes (Level 2B)	Focused Codes (Level 2C)	Theoretical Codes (Level 3)	Details of Level 2A
1	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Pivotal moments
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Reflect & reject assumptions
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Shame & respect
	Curriculum & IKS	1	2, 3	Relevant Science	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Quesiton relevance
	Curriculum & IKS	1			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Needs mismatch
	Curriculum & IKS	1			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Cultural diversity
	Curriculum & IKS	1	4, 5	Multiple worldviews	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Respect other views
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Importance of community
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Unlearn assumptions
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Diverse value sets
	Curriculum & IKS	2	6, 7	Fit for purpose curriculum	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Employment, skills development, human development, emancipation, societal contribution
	Curriculum & IKS	2			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	A need to be aware of purposes/meanings of curricula
	Curriculum & IKS	2			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Student centeredness
	Curriculum & IKS	2			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Threshold concepts
	Curriculum & IKS	3	8	IKS as dynamic	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IKS' value = a different worldview
	Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Avoid romanticization
	Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Humanistic & Ubuntu principles

Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Not a static knowledge
Curriculum & IKS	4	9	Complexity of Africanisation	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Avoid essentialising / polarizing
Curriculum & IKS	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK as equal to Western science
Curriculum & IKS	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Not western science 'validating' IK
Curriculum & IKS	4	10	Cooperativity (synergy, integration, reconnection) of Worldviews	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Students problematically radicalized
Curriculum & IKS	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Researchers not immoderate
Curriculum & IKS	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Integration, inclusivity
Curriculum & IKS	4	Value plurality		Valuing Plurality and Indigenous Knowledges	Vision(s)	Value add of diverse values	
Curriculum & IKS	5	11		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Reconnection
Curriculum & IKS	6	11		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Need conversations between worldviews
Curriculum & IKS	7	12		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Widen worldviews, interest, willingness
Curriculum & IKS	8	13, 14		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Critique all knowledge
Curriculum & IKS	9	15		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Openness, humility
Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Acknowledge multiple ways of knowing
Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Make attempts & learn & progress (wicked problem)

	Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Beyond examples (beyond just adding IK examples)
	Curriculum & IKS	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Lack of other voices/perspectives (e.g. students, community, elders)
	Curriculum & IKS	9	15	Systemic limitations	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Ridgid curricula
	Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Commercial value of IK
	Curriculum & IKS	10	16, 17	Extractivist research	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Assumed superiority of science
	Curriculum & IKS	10			Personal journey	Personal and Academic Journey	Journey	To transform curricula
	Curriculum & IKS	10			Personal journey	Personal and Academic Journey	Journey	To realise need for change
	Curriculum & IKS	10	18	Requires personal journey (reflection, process, grappling, transformation)	Personal journey	Personal and Academic Journey	Journey	Needs reflection & grappling/engagement with 'the difficulties'
	Curriculum & IKS	1			Professional development	Personal and Academic Journey	Journey	© personal journey
	Curriculum & IKS	1	1	Further study	Professional development	Personal and Academic Journey	Journey	Joy
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Experience of other cultures
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Connection
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Academic theories & terms & understandings of disconnects, poor student performance, T&L, philosophy
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Further study
	Curriculum & IKS	1	2, 3, 4	Personal journey	Personal journey	Personal and Academic Journey	Journey	Desire to improve & connect & offer meaning
2	Curriculum & IKS	1	5, 6, 7, 8, 9, 10, 11	Multiple worldviews	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Sociocultural constructivism

	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Respect
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Cultural border crossing
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Reflexivity
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Belief/faith: 'Fatima's Rues'
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Holding conflicting worldviews
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Disconnect or belonging (epistemological & ontological)
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Cognitive pain
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Parellel collateral learning' - Jegede
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	A curriculum as a worldview
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Conversaiton/dialogue/dance between worldviews
	Curriculum & IKS	2		Transformation	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Compassion
	Curriculum & IKS	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Integrate values
	Curriculum & IKS	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Beyond examples (beyond just adding IK examples)
	Curriculum & IKS	3	12		Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Rigour, relevance
	Curriculum & IKS	3	13		Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Corss-pollinaiton

Curriculum & IKS	3	14		Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Challenging
Curriculum & IKS	4			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Local plus global
Curriculum & IKS	4			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Africanize vs decolonize
Curriculum & IKS	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Different value systems disregarded
Curriculum & IKS	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Anger & history
Curriculum & IKS	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Deepen relationships
Curriculum & IKS	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Empathy
Curriculum & IKS	5	15, 16, 17	Marginalization	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Disconnect from ethics - science is not value free
Curriculum & IKS	6			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Link ontology (experience) & epistemology (knowledge)
Curriculum & IKS	7	18	Relevance	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Dialogue
Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Antidote to isolation
Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue & respect
Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Power sharing
Curriculum & IKS	9	19, 20	Ubuntu	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	T&L communities
Curriculum & IKS	9	21	Curriculum theory	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Need vehicles/terms for forwarding discussions of Africanisation
Curriculum & IKS	9	22, 23, 24	Reflexivity	Personal journey	Personal and Academic Journey	Journey	Cyclical

	Curriculum & IKS	9			Personal journey	Personal and Academic Journey	Journey	Rediscover (IK)
	Curriculum & IKS	9			Personal journey	Personal and Academic Journey	Journey	Keep critical questioning
	Curriculum & IKS	9			Personal journey	Personal and Academic Journey	Journey	Question own paradigms
	Curriculum & IKS	10			Personal journey	Personal and Academic Journey	Journey	Exposure to new ideas
	Curriculum & IKS	10			Personal journey	Personal and Academic Journey	Journey	Desire to learn
	Curriculum & IKS	10			Personal journey	Personal and Academic Journey	Journey	Shift pedagogic practices
	Curriculum & IKS	10	25	Process	Personal journey	Personal and Academic Journey	Journey	Take steps to transform
3	Curriculum & IKS	1	1	Personal journey (of transformation of own thinking/worldview(s))	Personal journey	Personal and Academic Journey	Journey	Introduction to IK - fuels desire to transform
	Curriculum & IKS	1	2,3,4	Integrating IK & science to widen knowledge	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Western science touted as universal knowledge system
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dismissal of African science (bleach IK)
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Science embodies culture
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Locally apt understandings
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Democratization of science
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Use IK examples in curriculum
	Curriculum & IKS	2			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	© integrate IK & science
	Curriculum & IKS	2	5,6	IK as experiential & experimental	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK as multigenerational

Curriculum & IKS	2	7, 8	Value IK	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local (culture & place-based) knowledge
Curriculum & IKS	2			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	People are an embodiment of their IK
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Western knowledge as local knowledge
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Equality of knowledges
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Demote the colonized (epistemicide)
Curriculum & IKS	4	9	Indigenize curriculum	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Equality of knowledges
Curriculum & IKS	4	10	IK as scientific (experiential, evidence based etc)	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Equality of knowledges
Curriculum & IKS	5	11, 12	Multiple knowledges as valuable	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local knowledge's explanatory power
Curriculum & IKS	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Appreciate other knowledges
Curriculum & IKS	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Else: alienation, disconnection, hegemony, tokenism
Curriculum & IKS	6	12, 13	Create new knowledge	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Integrate knowledges
Curriculum & IKS	6			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Uncertainty
Curriculum & IKS	6			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Self-respect
Curriculum & IKS	6			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Local language as empowering identity
Curriculum & IKS	7	14, 15	Reconnect	Connect+dialogue	Dialogue & Connection	Vision(s)	With social milieu (of Africa)
Curriculum & IKS	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Bridge the gap

	Curriculum & IKS	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Create accessible knowledge
	Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Knowlegde equality
	Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Language & knowledge interwoven
	Curriculum & IKS	8	16, 17	Value other knowledges	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Multidiciplinarity
	Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Knowledge (system) creates identity
	Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Remain open
	Curriculum & IKS	9	17	Teach values	Connect+dialogue	Dialogue & Connection	Vision(s)	Discuss differences & comonalities of knowledges - to value diversity
	Curriculum & IKS	10	18	Fear of the unknown	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Emotional identification with certain knowledge
	Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Insecurity
	Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Obsession with being correct (power)
	Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Humility, openness
4	Curriculum only	1	1, 2	Social justice	Social justice aims	Social Justice Aims	Vision(s)	Aware of educaiton failures (language, accessability, assimilationist model)
	Curriculum only	1			Social justice aims	Social Justice Aims	Vision(s)	Meaningful education, epistemic justice
	Curriculum only	1			Social justice aims	Social Justice Aims	Vision(s)	Personal journey
	Curriculum only	2	3, 4	Curriculum dimensions	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Who's valid/valued knowledge? Curriculum aims?
	Curriculum only	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Structure, setting, pedagogy, design, identity, cultural ssumptions, purpose

Curriculum only	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Hidden curriculum
Curriculum only	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Move to pluralism
Curriculum only	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Reject narrowing, identity politics, exclusion, privilege
Curriculum only	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Locally meaningful transformation
Curriculum only	3	5	Inclusion & diversity	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Include IK
Curriculum only	4			Question deeply	Reflection: Questioning Deeply	Journey	Differing 'knowledge structures'
Curriculum only	4			Question deeply	Reflection: Questioning Deeply	Journey	Moderate
Curriculum only	4			Question deeply	Reflection: Questioning Deeply	Journey	Avoid simplification, take first steps
Curriculum only	4	6, 7, 8	Uncertainty	Question deeply	Reflection: Questioning Deeply	Journey	Embed curriculum in context, cross cultural boundaries
Curriculum only	5			Personal journey	Personal and Academic Journey	Journey	Interrogate self & interrogate curriculum
Curriculum only	5			Personal journey	Personal and Academic Journey	Journey	Acknowledge disconnect
Curriculum only	5			Personal journey	Personal and Academic Journey	Journey	Engage in pedagogic theory & decolonial theory (as threshold concepts for lecturers)
Curriculum only	5	9, 10	Reflexivity	Personal journey	Personal and Academic Journey	Journey	Personal process
Curriculum only	6			Personal journey	Personal and Academic Journey	Journey	Contextual sensitivity
Curriculum only	6			Personal journey	Personal and Academic Journey	Journey	Relational sensitivity
Curriculum only	6	11, 12	Reflexivity	Personal journey	Personal and Academic Journey	Journey	Caring inclusion

	Curriculum only	6			Personal journey	Personal and Academic Journey	Journey	Face discomfort, acknowledge personal limits
	Curriculum only	6			Personal journey	Personal and Academic Journey	Journey	Striving
	Curriculum only	6			Personal journey	Personal and Academic Journey	Journey	Connect to students
	Curriculum only	7	13	Interrogate curriculum	Question deeply	Reflection: Questioning Deeply	Journey	Identify gaps & barriers to learning
	Curriculum only	7			Question deeply	Reflection: Questioning Deeply	Journey	Minimize power differential
	Curriculum only	7			Question deeply	Reflection: Questioning Deeply	Journey	Question knowledge selection
	Curriculum only	7			Question deeply	Reflection: Questioning Deeply	Journey	Understand audience/students (affective level, before cognitive level)
	Curriculum only	8	14	Power maintains hegemony	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Personal journey & discomfort to query & move against hegemony
	Curriculum only	extra	16	Scepticism	Question deeply	Reflection: Questioning Deeply	Journey	Wary of politicization & polarizaiton
	Curriculum only	extra			Question deeply	Reflection: Questioning Deeply	Journey	Wary of over simplificaion
	Curriculum only	extra			Question deeply	Reflection: Questioning Deeply	Journey	Stay open, explore complexity
	Curriculum only	extra			Question deeply	Reflection: Questioning Deeply	Journey	Call to action
5	Soil only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Curiosity
	Soil only	1			Personal journey	Personal and Academic Journey	Journey	A pure science
	Soil only	2	1	Further study	Professional development	Personal and Academic Journey	Journey	Inadequate undergraduate
	Soil only	2	2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Desire to help
	Soil only	2			Personal journey	Personal and Academic Journey	Journey	High impact of teaching

Soil only	2			Personal journey	Personal and Academic Journey	Journey	Job satisfaction
Soil only	4	3	Soil classification curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	SA soil classification
Soil only	5	3	Existing curriculm	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Based on SA soil classification handbook
Soil only	5			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Upgraded to newest handbook
Soil only	6	4	Conventional assessment	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Exams & tests
Soil only	6			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Practical: Consultancy report
Soil only	7	5, 6	Language challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Poor scientific English proficiency
Soil only	7			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Open book assessment (SA soil classification handbook)
Soil only	7			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Technical grammar (Scottish author)
Soil only	8	7, 8	Massification challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Adjust degree to student needs & skills
Soil only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Extra lecturer work
Soil only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Reduce detail of curriculum
Soil only	9	8, 9	SA Soil Classification Handbook (2018)	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Used as standard textbook
Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Additional study guide (based on textbooks)
Soil only	10	10, 11	SA Soil Classification Handbook (2018)	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	SSSSA endorsment

Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Official SA soil classification
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Shift in 2018 ver from agrigcultural ends, to environmental science & landuse management
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Soil as a natural entity
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Rushed publication, includes errors
Soil only	11	12	SA Soil Classification Handbook (2018)	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Considered local
Soil only	12	13	Science superiour	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Acknowledges neglected African history
Soil only	12			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Science higher yields; IK lower yields
Soil only	13	13, 14, 15	Science superiour	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Africanise poorly defined
Soil only	13			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK does not have a science framework
Soil only	13			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK less detailed; Science more detailed
Soil only	14	16	Local examples	Transformation: local examples	Transformation as Local Examples	Hindrances	Connect to students
Soil only	15	16, 17	SA soil science is already Africanised	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Local soil names
Soil only	15			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Compare western & IK classificaitons
Soil only	15			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Gap: scientific culture vs social culture
Soil only	15			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Connect to the familiar for students

	Soil only	16	17	Meaningfulness	Connect+dialogue	Dialogue & Connection	Vision(s)	Connection to the familiar
	Soil only	16			Connect+dialogue	Dialogue & Connection	Vision(s)	Aim: produce soil scientists, not extension officers
	Soil only	16	18	No soft skills taught	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Science dicipline does not include soft/communication skills
	Soil only	17	19	Massification challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Practical: site visit to soil pit
	Soil only	17			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Cancelled field trips
	Soil only	extra	22	Resistance to soil science being challenged	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Small community of SA soil scientists
	Soil only	extra			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Defensive against call to Africanise
	Soil only	extra			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Miscommunications between soil science & local implementation
	Curriculum & IKS	1	1, 2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Sense making
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Education development
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Value of diverse knowing & pedagogy
6	Curriculum & IKS	1	3	Systemic limitations	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Issue with wider curriculum & deficit thinking about certain students
	Curriculum & IKS	1			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Value of diverse knowing & pedagogy
	Curriculum & IKS	1	4	Social justice imperative	Social justice aims	Social Justice Aims	Vision(s)	Empathy & kindness
	Curriculum & IKS	1			Social justice aims	Social Justice Aims	Vision(s)	Differing values & logics (disconnect)
	Curriculum & IKS	1			Social justice aims	Social Justice Aims	Vision(s)	Power relations
	Curriculum & IKS	1			Social justice aims	Social Justice Aims	Vision(s)	Interrogate systemic assumptions/biases of the curriculum

Curriculum & IKS	2	5, 6	(Transformation) Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Question the (hidden) curriculum deeply (Pedagogical, epistemic & linguistic considerations of the curriculum)
Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Student protests sparked self & curriculum interrogation
Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Aim: social justice ends of education
Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Systemic biases
Curriculum & IKS	3	7, 8	Multiple valid ways of knowing	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Stereotypes & limiting definitions of IK
Curriculum & IKS	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Policy vs personal transformation
Curriculum & IKS	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Uncertainty & challenging
Curriculum & IKS	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Limitations of 'modern'/enlightenment disciplines & specialization & essentializing knowledge
Curriculum & IKS	4	8, 9	(Transformation) Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Student protests sparked awareness of need for 'deep' transformation
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Pedagogic & epistemic transformations
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Question politics of knowledge
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Not about essentializing knowledge(s), not about substituting 1 knowledge for another, entanglement of knowledge systems
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Acknowledge & include multiple knowledges (pluriversity)
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Centre the African experience

Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Complex modern issues/crises, need multiple approaches for robust solutions
Curriculum & IKS	5	9, 10, 11	Avoid polarization, engage multiplicity	Connect+dialogue	Dialogue & Connection	Vision(s)	Perspectives 'feel' personal
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Dialogue that avoids polarizaiton & engages multiplicity
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	IK & science are not actually oppositional
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Acknowledge IK & other multiple ways of knowing
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Beyond extractivist research & co-opting IK by capitalism
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Personal, dialogue & reflection (albeit academics overworked)
Curriculum & IKS	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Personal, dialogue & reflection (albeit academics overworked)
Curriculum & IKS	5	12	Deep transformation	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Forced, or willing transformaiton
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Systemic transformation required
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Policy led can work (e.g. Zim legitimized IK)
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Dialogues have started
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Dialogues have started
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Needed at all levels: indivual, mass action (protest), state policy
Curriculum & IKS	8	13, 14	Deep transformation	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Curriculum as: knowledge, content, pedagogy, systemic structures
Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Deconstruct & interrogate transformation of all curriculum aspects
Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Reflexive questioning
Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Reveal assumptions/motives for choices re content

Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Decolonial perspective
Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Aims: social justice, centre african experience
Curriculum & IKS	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Capitalist values systemic to the university
Curriculum & IKS	9	15	Reflexive questioning	Question deeply	Reflection: Questioning Deeply	Journey	Self critique
Curriculum & IKS	9	16, 17		Connect+dialogue	Dialogue & Connection	Vision(s)	Between social & hard sciences
Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Between horizontal & vertical knowledge ystems (see Basil Bernstein)
Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Between lecturer & students
Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Integrate local/existing/student knowledge
Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Open dialogue
Curriculum & IKS	9		Bridge the gap	Connect+dialogue	Dialogue & Connection	Vision(s)	
Curriculum & IKS	10	18, 19		Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Open mindedness required; many closed minded people/scientists
Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Dialogues required to progress
Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	University knowledge is alienating to all; privledge increases access
Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Lecturers are dicipline experts, not pedagogues
Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Rote learning & unrealistic expectations
Curriculum & IKS	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Massificaiton & diversity
Curriculum & IKS	10		Challenges to transformation	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	
Curriculum & IKS	11	20	Lecturer as facilitator	Connect+dialogue	Dialogue & Connection	Vision(s)	Students as self-directed learners

	Curriculum & IKS	11			Connect+dialogue	Dialogue & Connection	Vision(s)	Bridges the gap
7	IKS only	1	1, 2	IK as normal & valid/valued knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK as: enviro. Management, sustainable/low impact, spiritual culture, primary rules for living (practical metaphor)
	IKS only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK is threatened, diminished
	IKS only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Hybrid IK & western knowledge to provide multiple solutions to complex problems
	IKS only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK needs to be elevated & equally valid
	IKS only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue between knowledges
	IKS only	1	3	Culture informs responses	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Cultural resonance, increases uptake of interventions/teaching/project
	IKS only	2	3, 4, 5	IKS are local & contextual knowledges	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Reflects experiences of a culture
	IKS only	2			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Locally tailored: experimental, trial & error, dynamic, adaptive
	IKS only	2			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local priorities/context/changes drive IK generaiton
	IKS only	2			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK accepts multiple realities/truths (not confined to single truth)
	IKS only	2	6	IK inclusive of multiple perspectives	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Science: one positivist deterministic truth/reality
	IKS only	3	7, 8, 9	Local relevance needed	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Plasticity: problems have different perspectives, thus solutions need a variety of knowledges, esp. local ones
	IKS only	3			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Universalizing issues/knowledge/solutions fails
	IKS only	3			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Local relevance = increased uptake
	IKS only	3			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	All knowledges valuable

IKS only	3			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Multidisciplinarity (multiple perspectives needed)
IKS only	3			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Global weirding
IKS only	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Effective local strategies
IKS only	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Rejection of western knowledge in favour of IK (mistrust)
IKS only	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Need hybrid of western & IK knowledges
IKS only	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Urban loss of IK
IKS only	4	10, 11, 12	IKS are local & contextual knowledges	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Include IK in curricula
IKS only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	A learning journey for scientists
IKS only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue between knowledges
IKS only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK to be deemed equal & valid
IKS only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Take scientists to IK in-situ
IKS only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Include IK in curricula
IKS only	5	13, 14, 15	Bring IK into tertiary spaces	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Empasise local research (&IK) in local journals
IKS only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Mutual accomodation (of knowledges)
IKS only	6	16, 17	Conviviality	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Promote experiences of IK

	IKS only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Question western status quo
	IKS only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue includes tension, but close engagement (like dance)
	IKS only	7			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Curricula to respond to African problems/needs from an African perspective
	IKS only	7			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Problems are contextual, solutions need to be locally contextual
	IKS only	7	17, 18	Meet local needs	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Question relevance/connection/apropriateness
	IKS only	7			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Promote african scholarship & experts
	IKS only	7			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Quesiton standards & definitions, and who defines them
	IKS only	7	19	Promote/value local knowledge	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Africanisation as an inclusive process
	IKS only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Promote local publishers
	IKS only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Undermine african aspirationalism to western facade of superiority
	IKS only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Academic freedom
	IKS only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Western structures/frameworks, promote/favour western perspectives/ways of knowing
	IKS only	extra	21	Promote/value local knowledge	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Undermine extractivist research by foreigners in africa
	Soil only	1			Personal journey	Personal and Academic Journey	Journey	Career/emplyoment/money choices drove decisions
	Soil only	1			Personal journey	Personal and Academic Journey	Journey	Lecturer affected career choice
8	Soil only	1	1, 2	Desire to farm	Personal journey	Personal and Academic Journey	Journey	Influence of childhood experiences

Soil only	2	2, 3	Personal journey	Personal journey	Personal and Academic Journey	Journey	Bursary facilitated further study
Soil only	2			Personal journey	Personal and Academic Journey	Journey	Important experience of local rural study site (engaged with local knowledge of local site)
Soil only	2			Personal journey	Personal and Academic Journey	Journey	Degree shaped career choices
Soil only	2			Personal journey	Personal and Academic Journey	Journey	Teaching & curriculum development contracts during PG studies
Soil only	3	4, 5	Process pedogenesis & soil classification curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	4	6	Process pedogenesis & soil classification curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	5	6, 7	Inherited, but adapted curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Official 2018 SA soil classification
Soil only	6	7, 8, 9	Assessment follows university guidelines	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Covid impact: only assignments, no exam
Soil only	6			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	60% exam : 40% semester [practical & semester test & class tests]
Soil only	6			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Class tests to drive class attendance
Soil only	6			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	7	10	Disconnect	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Lecturer expectations vs, student behaviour & performance
Soil only	7			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Plagiarism, online assessment challenges
Soil only	8	10	Systemic challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Inherited 'thin' curriculum
Soil only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Covid & online limitations, compared to contact teaching & problem solving lectures

Soil only	8	11, 12	Pedagogic interventions	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Desire to support students (in light of systemic challenges)
Soil only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Scaffolding, tailored feedback, open book assessment [open book aligned with real world]
Soil only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Significant lecturer workload
Soil only	8	13, 14	Valuable professional pedagogic development	Professional development	Personal and Academic Journey	Journey	Useful university induction to pedagogic theory & practice
Soil only	8			Professional development	Personal and Academic Journey	Journey	Variety of assessment types, scaffolding, learn by doing
Soil only	9	15, 16, 17	Readings provided	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Expense of textbooks
Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Course notes as textbook
Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Inherited 'thin' curriculum
Soil only	10	18, 19, 20, 21	Inadequate textbook	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Difficult to understand, poor examples, too theoretical
Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Created suitable course notes/stud guide
Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	SA soil classification (green book 2018) - is a rulebook, not a textbook
Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Cost of textbooks a barrier to students
Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Green book 2018 - official SA soil classification - pointless not to teach it
Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Fey 2010 - not a classification schema, but a grouping to discuss pedogenesis (for comparison to WRB)
Soil only	10	22	SA classification is for communication	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Functional grouping of soil (classes) for professional communication

Soil only	10			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Expensive to map soil properties (needs lab)
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Teaching soil classification is limited to official green book (2018)
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Some IK in classification, but just soil names
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Soil IK is very local & practical
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Lack of collection of SA soil IK
Soil only	11	23	Structural limitations	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	No capacity for students to visit field/farms
Soil only	11			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Africanisation as an academic/political term for common sense
Soil only	11			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Humility to listen to locals' soil knowledge (else western egoism)
Soil only	11	24, 25	Local knowledge is common sense	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Learn practically on the job (university disconnected from profession)
Soil only	12			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Free' university implausable, students must pay, lazy students
Soil only	12	26	Reject Africanisation	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Rather meet students where they are at - thus a need to find out who they are
Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Need to teach theory, but need to teach for real world
Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Teach to the African majority (neglect high achievers)
Soil only	12	27	Balancing dichotomy is difficult	Connect+dialogue	Dialogue & Connection	Vision(s)	Empathy to connect across the gap between student & lecturer
Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Find out who students are (short life essay)
Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Possibility of shifting worldview, by viewing students' worldviews/experiences
Soil only	12	28, 29	Effort to connect with students	Connect+dialogue	Dialogue & Connection	Vision(s)	Local & relevant examples

	Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Difficult to connect with diverse groups
	Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Rather risk trying & learning
	Soil only	12			Connect+dialogue	Dialogue & Connection	Vision(s)	Poor class attendance
	Soil only	13	29, 30	Meet students where they are 'at'	Connect+dialogue	Dialogue & Connection	Vision(s)	Contextually relevant knowledge - supports conneciton
	Soil only	13			Connect+dialogue	Dialogue & Connection	Vision(s)	Lecturer (epistemic) humility
	Soil only	13			Connect+dialogue	Dialogue & Connection	Vision(s)	High lecturer work load
	Soil only	14	31	Aim: bridge the knowledge gap	Connect+dialogue	Dialogue & Connection	Vision(s)	Break down jargon
	Soil only	14			Connect+dialogue	Dialogue & Connection	Vision(s)	Strive to communicate
	Soil only	15	31	Curriculum tailored to students	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Each cohort unique
	Soil only	15			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Discern where students are at
	Soil only	15			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Meaningful local examples
	Soil only	16	32	Ethnopedology not in curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Include local soil knowledge (Afrikaans, African etc)
	Soil only	16			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Inclusivity
	Soil only	17	33	Context NB for practicals	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Covid cancelled practicals
9	Soil only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	External factors shaped choices (university entrance requirements, poor career guidance)
	Soil only	1			Personal journey	Personal and Academic Journey	Journey	Employability influenced decisions
	Soil only	2	2	Research ⇌ Teaching	Reciprocity	Reflection: Questioning Deeply	Journey	Postgrad studies led to teaching
	Soil only	2			Reciprocity	Reflection: Questioning Deeply	Journey	Scholarship made PG possible
	Soil only	3	3, 4, 5, 6, 7, 8	Introduction to Soil Science curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	See: trascription p.4 reverse, for summary table of these 4 modules

Soil only	3		Pedology	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	3		Soil Taxonomy	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	3		Soil mapping	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	4	8	Course outlines	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	5	8	Recurriculated & inhereted curriculula	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	See: transcription p.8 & 9 for details
Soil only	6	9, 10	Structural limitations	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Massification challenges (esp. practicals - self-organised visit to nearby soil profiles, fieldwork videos, desktop practicals)
Soil only	6			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Exam 50% : Semester 50% [50% tests, 3max + 20% assignments, 4 of 5% each + 30% practicals)
Soil only	7	11	Massification challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	High workload & delayed marking assessments, avoid feedback
Soil only	7	11	Student challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Trained in rote leanring, not application/problem solving
Soil only	7			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Poor technical english language proficiency
Soil only	7			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Difficulty with higher order quesitons & interpretation
Soil only	8			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Tutor suppor high student numbrs, but also weak students
Soil only	8	12	Tutoring	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Tut class & 1-on-1 consulting
Soil only	8	13	Assessment training	Professional development	Personal and Academic Journey	Journey	Rubrics & explain assessment terminology (bloom's)
Soil only	9	14	Course materials & textbook	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Recommended only, course handouts provide 90% info

Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	See: transcript p.14 for details of 'recommended' readings/textbooks for each module
Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Textbooks are foreign
Soil only	9	15	Universlising principles; unique local conditions	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Textbooks cover introductory universal soil science principles, but lack of textbooks for local conditions
Soil only	9	16	Research ⇌ Teaching	Reciprocity	Reflection: Questioning Deeply	Journey	Use own academic research & articles, to teach in class (remains up-to-date, while textbooks easily dated)
Soil only	10	17, 18	Inherited standard textbook	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Textbook good at intro to universal soil science principles - but too much detail
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Students do not buy textbook - lecturer course notes cover 90% of info
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Students want 'spoon-fed' notes - no longer independent learning
Soil only	11	18	Include IK classifications in course	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	
Soil only	11			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	
Soil only	11			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Compare western classifications & IK; IK not for assessment
Soil only	11	19	IK as practical knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Geophagy, grave sites
Soil only	11			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK cannot meet diverse classes' needs
Soil only	11	20, 21	IK inclusion opens discussion - builds conneciton	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK values (which underpins IK reasoning) differ from science's values (reasons) - perceived disconnect between IK & science
Soil only	11			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Students may have IK, relate to IK, fosters connection
Soil only	12	22	Context affects application of principles	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Principles are universal, local context is unique

	Soil only	12			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	See: p.22 opposite - discussion on principles being a set of agreements by a contextual community
	Soil only	12			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Mutual accomodation (of knowledges) (global & local)
	Soil only	13			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Mutual accomodation (of knowledges) (global & local) - complementary
	Soil only	13	23	Universal principles, local examples	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Understand different perspectives & also similarities
	Soil only	14	24	Empasise African knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Use local examples
	Soil only	15			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Cannot apply (inflexible) international classifications effectively in SA locale
	Soil only	15	24	Empasise African knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Formal inclusion of IK in curriculum
	Soil only	16			Connect+dialogue	Dialogue & Connection	Vision(s)	Link local experience/reality, with abstract & prescriptive scientific theory
	Soil only	16	26	Ethnopedology inspiring to students	Connect+dialogue	Dialogue & Connection	Vision(s)	Common ground/link/bridge gap between science & IK/locale
	Soil only	17	27	Local relevance as primary	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	African context, incl. NB social
10	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Career & interests informed journey
	Curriculum & IKS	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Curriculum as a political tool (established societal values)
	Curriculum & IKS	2	1	Transformation of flawed curriculum	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Curriculum should foster critical thinking
	Curriculum & IKS	3			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	IK does not meet all parameters of propositional/theoretical knowledge in being a Justified True Belief
	Curriculum & IKS	3	2, 3, 4	IK is poorly defined	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	IK is fundementally relitavist
	Curriculum & IKS	4	5	Africanisation as relevant curriculum	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Counter colonial

	Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Reclaim IK
	Curriculum & IKS	5			Question deeply	Reflection: Questioning Deeply	Journey	IK enrich academica, exclude superstition
	Curriculum & IKS	5	6, 7	Critically interrogate IK	Question deeply	Reflection: Questioning Deeply	Journey	Interrogate contradictions between IK & science
	Curriculum & IKS	6	8	Africanisation as local relevant curriculum	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	but IK not a unique science
	Curriculum & IKS	7	8	Understand students' context	Question deeply	Reflection: Questioning Deeply	Journey	Meet learners where they are at
	Curriculum & IKS	8	9	Critical inquiry	Question deeply	Reflection: Questioning Deeply	Journey	Ensure relevance
	Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Understand students' context
	Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Extractivist research of IK
	Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	IK as practical & sustainable
	Curriculum & IKS	9	9, 10	Bridge intercultural (epistemic) gap, using IK	Connect+dialogue	Dialogue & Connection	Vision(s)	Draw parallels between knowledges
	Curriculum & IKS	10	11	Transformation as a sensitive & inclusive necessity	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Make science relevant & inclusive
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Own student experience of alienation/imposter syndrome/disconnect -> desire to connect/teach meaningfully
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Transformation for sustainable development
	Curriculum only	1	1,2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Intuition informed journey
	Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transformation of purpose (why) of curricula
11	Curriculum only	2	3, 4	Transformation, beyond what, also why	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Curriculum transformation for: humanizing & relationality, reflexivity/critical thinking, contextually meaningful

Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Necessarily a process
Curriculum only	3	4, 5	Recentring Africa	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Integration of west & african knowledges
Curriculum only	3			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Relevance = connection to context
Curriculum only	4	5, 6	Link knowledge to life experience	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Create accessible knowledge (abstract to concrete)
Curriculum only	4			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Whereas science values to disconnecting knower from the known (for objectivity) - hence alienation
Curriculum only	5	6, 7, 8, 9, 10	Transformation beyond examples	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	IK is inherently cultural
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Include student/community knowledge/experience
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Openness & dialogue
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Problematic to 'validate' IK against western science
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Resistance to change (students & lecturers) - entrenched rote learning
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Significant lecturer workload
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Social learning, authentic asesments - foster connecition
Curriculum only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Curriculum as process
Curriculum only	5	11	Loosen bounds of the curricula	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Oppenness & vulnerability - to allow curriculum to 'unfold/develop' (by including/dialoguing student knowledge)
Curriculum only	6	12	Openness & vulnerability	Connect+dialogue	Dialogue & Connection	Vision(s)	Theory U (Otto Scharmer)

Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Develop capacity to face discomfort (professional academic development)
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Listen to diverse views non-judgementally
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Extensive curriculum
Curriculum only	6	14	Trust (the process)	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Release control
Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Broader value-based outcomes (affective domain)
Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Change as a gentle process
Curriculum only	7	15	Professional academic development	Professional development	Personal and Academic Journey	Journey	Staff dialogues, sharing & reflections
Curriculum only	7	16, 17, 18, 19	Transformation beyond (changing) examples	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transform: staff, assessments, pedagogy, university culture
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Question deeply, reflective practice, engaged with T&L literature/research
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Students as co-participants in curriculum transformation (student agency)
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Need leadership buy-in (structural transformation)
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Process, no quick-fix
Curriculum only	8	20	Need commitment to transformation	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Protests increased awareness, sparked staff discussions
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Dialogues lead to incremental shifts
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Risks attempts at transformation - reflect - learn - revise - repeat

	Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Passion & motivation to share knowledge (teach)
12	Curriculum only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Desire to see theory turn to praxis
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Social justice motivations
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Despite theory, systemic inequalities remained
	Curriculum only	1	2	Meso & macro dynamics shape curriculum	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Problematic politics of decolinisaiton
	Curriculum only	1	2	Resistance	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Scientific peer-pressure to conform to diciplinary canon (and distrust transformation)
	Curriculum only	1	3	Decolonisation as a local process	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Local dialogues to appreciate local (differing) positions
	Curriculum only	1			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	These dialogues are fraught
	Curriculum only	1			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Need to identify dominant institutional values
	Curriculum only	1	4	Disconnect = distrust	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Desire for systemic change
	Curriculum only	2	5	Transformation as multifaceted	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Transformation as: S.A. context; constitutional; social justice; digital; dynamic; content but also structural
	Curriculum only	2			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Transformation at micro(curriculum); meso(institutional); macro(national/global)
	Curriculum only	2	6, 7, 8	Institutional constraints	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Quality assurance; inter-diciplinary power relationships; legitimized by journals; weak pedagogic theory; students not experts; academics have low agency compared to policy; institutional power resists change; trust is broken
	Curriculum only	3	9	Africanisation as politicised	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Co-opted as an essentialist idea; toxic to diversity
	Curriculum only	3	10, 11	Plural/diverse epistemics needed	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	All knowledge is contextual, no universal knowledge system

Curriculum only	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Complex local understandings; concerns with essentialism
Curriculum only	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Difficult to legitimize other knowledges (university holds power & power validates knowledges)
Curriculum only	3			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Question fundamental assumptions deeply (about 'truth' of knowledge & 'grand' narratives)
Curriculum only	4			Question deeply	Reflection: Questioning Deeply	Journey	Question the canon (vertical[hegemonic] knowledge structure)
Curriculum only	4	12, 13	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Reflexivity; engage with complexity; unearth power dynamics between knowledges
Curriculum only	4			Limitations	Status Quo: Tensions and Limitations	Hindrances	Policy & funding & global H.E. not aligned to Africanisation
Curriculum only	4	14, 15	Global/national disconnected from local	Limitations	Status Quo: Tensions and Limitations	Hindrances	Global/national power dynamics restrict/limit agency at local/micro curriculum level
Curriculum only	5			Question deeply	Reflection: Questioning Deeply	Journey	What the discipline/canon includes & excludes
Curriculum only	5			Question deeply	Reflection: Questioning Deeply	Journey	Beyond content; pedagogical practices; curriculum fit for purpose
Curriculum only	5			Question deeply	Reflection: Questioning Deeply	Journey	Is what we say(want critical thinking) & what we do (assess rote learning) congruent?
Curriculum only	5	16	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	University mirrors capitalism: extractivist accumulation of power/knowledge
Curriculum only	5	17	Research ⇌ Teaching	Reciprocity	Reflection: Questioning Deeply	Journey	Reflexivity leads to openness
Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Engage with the unknown/complex/plural, be open & trust that value will result (welcome the wicked problem)
Curriculum only	6	17, 18, 19	Engage in process	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Sciences are closed/definitive/not-open/essentialize - need a paradigm shift to pluralism
Curriculum only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Beyond enlightenment compartmentalization
Curriculum only	6	20	Plurality valued	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Embracing plurality needs one to be humble/open (in not knowing everything/expert ego)

	Curriculum only	7	20, 21	Openness	Connect+dialogue	Dialogue & Connection	Vision(s)	Personal desire to transform/be open/be inclusive/curious, not be defensive/closed/exclusionary
	Curriculum only	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Product based knowledge, vs. process based knowledge
	Curriculum only	7			Connect+dialogue	Dialogue & Connection	Vision(s)	What enables openness?
	Curriculum only	8	22, 23	University is traditional	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Promotes conformity; institutionalized reward systems; cater to producing student-product & research-product
	Curriculum only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Power resists change/transformation; system reproduces itself; conformity=legitimacy
	Curriculum only	extra	24	Risk experimenting	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Willingness to change
	Curriculum only	extra	24	Transformation at all levels	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Not just micro-curriculum; also meso & macro structures
13	Curriculum only	1	1	Professional academic development	Professional development	Personal and Academic Journey	Journey	Diversity programme
	Curriculum only	1	2	Reflexivity	Personal journey	Personal and Academic Journey	Journey	Inspired by T&L theory
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Questioned fit for purpose curricula
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Found personal meaning in transformation
	Curriculum only	2	3	Transformation aim as equitable	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Responsive to needs/fit for purpose/contextually relevant/goals & practices aligned/sensitive to diversity
	Curriculum only	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Connect to student experience/knowledge (to overcome disconnect of abstract theory, preceived as irrelevant) & foster engaged learning
	Curriculum only	2	3, 4	Meaningfull learning outcomes	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Question aim of degree (within local context)
	Curriculum only	2			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Staff disconnected from sense of meaning in teaching - just producing student-product with degree
	Curriculum only	3	4, 5	Uncertain, ill defined	Question deeply	Reflection: Questioning Deeply	Journey	Question deeply, context dependent, transform content & pedagogy, student centred, aspirational3

Curriculum only	4	5	Definition needed	Question deeply	Reflection: Questioning Deeply	Journey	A lack of definition of Africanisation
Curriculum only	4			Question deeply	Reflection: Questioning Deeply	Journey	Definition is context specific
Curriculum only	4	6	Subjectivities as valuable	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Intangible measures as valuable
Curriculum only	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Diverse (local) perspectives as valuable
Curriculum only	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	The local is erased by universalizing of science
Curriculum only	4	7, 8	Know thy students	Connect+dialogue	Dialogue & Connection	Vision(s)	Can only address local needs, by knowing what(who) they(students) are
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Science dismissive of social/emotional contexts as valuable to science
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Engaging with complexity - not rewarded by university systems - time intensive to unearth
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Questionnaires, field trips, informal social connection
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Cultivate empathy - allows connection to student - allows meaningful transformation of T&L to meet needs
Curriculum only	5	9, 10	Institutional transformation guidelines	Status quo	Status Quo: Tensions and Limitations	Hindrances	Need a guiding framework - frustration, hard to measure progress
Curriculum only	5			Status quo	Status Quo: Tensions and Limitations	Hindrances	Change institutional culture (policy in context), leadership required
Curriculum only	5			Status quo	Status Quo: Tensions and Limitations	Hindrances	Qualitative & social criteria, based on deep questions
Curriculum only	5	11	Locale dictates transformation	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Social conditions are drivers of change
Curriculum only	5			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	For curricula to be responsive to needs
Curriculum only	6	12	Transformation principles	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Applied with sensitivity to context

	Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Social justice needs, equitable access, responsive curriculum/fit for purpose, critical thinking
	Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	How is uncertain, what is clear (trust process)
	Curriculum only	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	As aligned to curriculum purpose, e.g. critical thinking, sensitivity to epistemic diversity, inter-personal group skills
	Curriculum only	6	13	Qualitative curriculum outcomes	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Quality of thinking, over quantity of rote content
	Curriculum only	6			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Rote learning does not support critical thinking
	Curriculum only	6	14	Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transform pedagogy (challenging in practice)
	Curriculum only	6	14	Positive attitude	Connect+dialogue	Dialogue & Connection	Vision(s)	Believe in students' capacity to learn
	Curriculum only	7			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Compare & contrast different contexts & their understandings
	Curriculum only	7			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Foster appreciation of differences (suspend judgement) & learn from diversity
	Curriculum only	7			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Value complexity & learn skill of holding differing perspectives
	Curriculum only	7	15, 16, 17	Contextual understandings	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Beyond own single worldview
	Curriculum only	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Of academics
	Curriculum only	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Don't generalise
	Curriculum only	8	17	Engage diversity	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Question: how is it valuable for an academic to transform?
	Curriculum only	extra	19	See p.19 overleaf	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	
14	IKS only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Childhood - IKS as worldview/normal

IKS only	1			Personal journey	Personal and Academic Journey	Journey	Schooling rejection IKS (assertion of superior knowledge) (disconnect)
IKS only	1			Personal journey	Personal and Academic Journey	Journey	Postgrad bursary, IKS research (curiosity)
IKS only	2	1, 2	IKS as cultural worldview	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Difficult to define, very contextual
IKS only	3	2, 3, 4	Africanisation as negation of west	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Problematic; what African 'solutions' to the probems of western knowledge?
IKS only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Praxis needed (beyond theory)
IKS only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Is Africanisaiton fit for purpose, to produce skilled graduates in a globalised, industrialised, neoliberal world/economy?
IKS only	3	5	Africanisation coopted by politics	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Africanisation as meaningful (not romanticized), not to satisfy political agrandizement
IKS only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Africanisation as a holistic process - up & downstream of the university - for social justice ends
IKS only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Disconnect/distrust between potitical lipservice & actions (e.g. their kids go to private english schools)
IKS only	4	6, 7	Structural Africanisaiton needed	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Beyond micro-curriculum & content
IKS only	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Develop African terminologies - language as the vehical of an epistemic (beyond translation)
IKS only	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Incomensurate concepts between epistemics
IKS only	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transformation as: pedagogic, linguistic, epistemic (big project)
IKS only	5	7, 8	Structural Africanisaiton needed	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Long term project; dialogue with community soil IKS holders; meaningful inclusion (not lip-service); humility; mutual value
IKS only	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Remain discerning (critical thinking)

	IKS only	6	9	Sincerity	Connect+dialogue	Dialogue & Connection	Vision(s)	Meaningful inclusion is sustainable (tick-box is not)
	IKS only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Question purpose of IKS inclusion deeply (motivations)
	IKS only	7	10	Leadership buy-in	Connect+dialogue	Dialogue & Connection	Vision(s)	Systemic transformation; sincere belief in value of IKS; action beyond policy
	IKS only	7	11	Identify importance of IKS inclusion in curriculum	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Vigorous discourse/debate/dialogue
	IKS only	7			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Ensure student buy-in
	IKS only	7			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Deeply question meaning/unique value of IKS inclusion
	IKS only	extra	15	IKS in indigenous language	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Question language deeply (language & epistemic inextricably intertwined)
15	Curriculum only	1	1, 2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Upbringing - perceived inferiority, low self-esteem
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Alienation/disconnect at university
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Connection to own knowledge - reclaim epistemic agency & self-worth
	Curriculum only	11			Personal journey	Personal and Academic Journey	Journey	Passion, desire to do good & enact change
	Curriculum only	1	3	Positivism limitations	Limitations	Status Quo: Tensions and Limitations	Hindrances	Positivism deemed superior knowledge
	Curriculum only	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Measuring dictate research agenda
	Curriculum only	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Rather, connections/communication/diversity advance knowledge/critical thinking
	Curriculum only	1	4	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Local languages not simple solution to transformation
	Curriculum only	1			Question deeply	Reflection: Questioning Deeply	Journey	Meaning/cosmology are more NB than language, as worldviews can persist in other languages

Curriculum only	1			Question deeply	Reflection: Questioning Deeply	Journey	Question ontological assumptions (in the discipline)
Curriculum only	1			Question deeply	Reflection: Questioning Deeply	Journey	Connecting to familiar experiential (ontological) knowledge is easier
Curriculum only	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Disconnect between lived experience & universal worldview of positivism
Curriculum only	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Negates ontological & epistemic plurality (Science as a system of exclusion)
Curriculum only	1	5, 6	Positivism limitations	Limitations	Status Quo: Tensions and Limitations	Hindrances	Arbiters of valid knowledge; retain control of knowledge production & the power thereof
Curriculum only	2			Reciprocity	Reflection: Questioning Deeply	Journey	A pedagogical/learning process
Curriculum only	2	6	Research $\rightleftharpoons$ Teaching	Reciprocity	Reflection: Questioning Deeply	Journey	Self-locus of learning
Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Resistance for autonomy (e.g. zapitistas)
Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Locale shapes forms of resistances/decolonisation - from a desire to belong (to ones' self/ones' home)
Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Trust the process - patience, listening, respect
Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Beyond curriculum transformation (and epistemic access to hegemonic structures & reproduction of existing problematic epistemics)
Curriculum only	2	7, 8	Transgressive pedagogies	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Systemic change needed: relational transformation, co-creation, contextually relevant, pluralism, transdisciplinarity, anti-racist, experiential T&L
Curriculum only	2			Question deeply	Reflection: Questioning Deeply	Journey	Values foundational to western canon (class exercise & invite student values)
Curriculum only	2			Question deeply	Reflection: Questioning Deeply	Journey	Push beyond only western worldview (for new meaning making)
Curriculum only	2	9	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Interrogate values of other knowledge systems (e.g. ubuntu)

Curriculum only	3	10	Beyond personal	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Defensive against call to Africanise/black thought/transformation - as threatens identity/ego & privilege/power
Curriculum only	3			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Silences change, maintains status quo
Curriculum only	3	11	Africanisation as insufficient	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Isolationism is problematic
Curriculum only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	No universal epistemic - plurality in order to know
Curriculum only	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Dialogues between incomplete epistemics (synergies)
Curriculum only	4	11	Plurality	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Co-researchers, epistemic equality, take risks - make attempts
Curriculum only	4	12	Locally relevant	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Cosmovision aligned to locale
Curriculum only	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Sense of community
Curriculum only	5	12	Curiosity	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Epistemic boundries of sciences are inflexible
Curriculum only	5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Student involvement
Curriculum only	5	13	Plurality	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Alternate pedagogies (not rote learning)
Curriculum only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Beyond diciplines
Curriculum only	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Diversity of facilitators/lecturers
Curriculum only	5	14, 15	Racism	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Eurocentric dismissal of other epistomologies
Curriculum only	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Denial of racism perpetuates racism

Curriculum only	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Dialogue the discomforts
Curriculum only	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Falsehood of european 'perfection', while system is also dysfunctional
Curriculum only	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Homogenised western culture
Curriculum only	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Minorities marginalised
Curriculum only	5	16, 17	Eurocentricism	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Africa 'teaches' the west diversity (need dialogue)
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Abysal line - 'other' is less than fully human
Curriculum only	6	17	Humanism	Connect+dialogue	Dialogue & Connection	Vision(s)	Dignity/equality/acknowledgement as anti-racist
Curriculum only	6	18	Communities of care	Connect+dialogue	Dialogue & Connection	Vision(s)	Small groups - offer dialogue, dignity, epistemic recognition
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Else, scientific epistemic hegemony remains
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transformaiton as: worldview equalities
Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Diversity of attempts at transformation
Curriculum only	7	18, 19	Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Quesiton deeply to move forward
Curriculum only	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Connected to community (beyond the university)
Curriculum only	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Small facilitated groups
Curriculum only	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Respect diversity; inclusivity
Curriculum only	8	19, 20	Humanism	Connect+dialogue	Dialogue & Connection	Vision(s)	Include/led by student knowledge/lived experience (co-creation) (meaningful relating & dialogue)

Curriculum only	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Overcome material oppression first
Curriculum only	8	21	Critical thinking	Question deeply	Reflection: Questioning Deeply	Journey	Don't need lecturers, need facilitators (information is available)
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Skills, over repetition of knowledge
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Rote learning habit
Curriculum only	8	22	Process	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Imperfect progress (learning)
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Shift structures to just education
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Transform to college of knowledges (pluriversity)
Curriculum only	8	23, 24	Critical thinking	Question deeply	Reflection: Questioning Deeply	Journey	Failures of 'universal' knowledge to explain everything
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Students don't question university knowledge
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Conversation between knowledges (validate other knowings)
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Outcomes unknown (knowledge is not complete)
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Guide/facilitate, not lecture
Curriculum only	8			Question deeply	Reflection: Questioning Deeply	Journey	Question origins/genesis of discipline's canon
Curriculum only	8	25	Teacher ⇌ Student	Reciprocity	Reflection: Questioning Deeply	Journey	Facilitator training (unlearning for lecturers)
Curriculum only	8			Reciprocity	Reflection: Questioning Deeply	Journey	Use positional power for justice
Curriculum only	8			Reciprocity	Reflection: Questioning Deeply	Journey	Dialogue multiple epistemics

Curriculum only	8			Reciprocity	Reflection: Questioning Deeply	Journey	Respect, humility
Curriculum only	8			Reciprocity	Reflection: Questioning Deeply	Journey	Not about right/wrong/known everything (divest power)
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	All knowledge is incomplete
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Transformation contextually sensitive
Curriculum only	8			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Start from student known/valid knowledges; bottom-up knowledge generation
Curriculum only	8	26, 27	Facilitated knowledge discovery	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Curriculum in areas of interest, dialogue between interest groups
Curriculum only	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Transformation for skills
Curriculum only	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Process learning
Curriculum only	8			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Student reflexive writing
Curriculum only	8	28	Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Project-based learning
Curriculum only	extra	31		Connect+dialogue	Dialogue & Connection	Vision(s)	Acknowledge the possibility of diverse solutions; honour the context
Curriculum only	extra	31	Humility	Connect+dialogue	Dialogue & Connection	Vision(s)	Allow for bottom-up debate & knowledge creation
Curriculum only	extra			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	High facilitator work-load
Curriculum only	extra			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Patience: make best attempt, and learn, and progress
Curriculum only	extra	32	Process	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Motivation: passion for change
Curriculum only	extra	33	Project-based learning	Experience	Fit 4 Purpose & Learning Context	Vision(s)	No exams (dutch model)

	Curriculum only	extra	34	Beyond the university	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Foster application & critical thinking
	Curriculum only	extra			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Beyond rote-learning
	Curriculum only	extra			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Parallel learning systems
16	Soil only	1	1	Job opportunity	Personal journey	Personal and Academic Journey	Journey	Followed by further studies in Soil Science
	Soil only	2	2	Network	Personal journey	Personal and Academic Journey	Journey	Invited to teach (land evaluation) due to expertise
	Soil only	3	2	Land evaluation & soil classification curriculum	Status quo	Status Quo: Tensions and Limitations	Hindrances	4th & 3rd year, respectively. (Interview focuses on soil classification curriculum, as was much more recent.)
	Soil only	4	3	Curriculum structure	Status quo	Status Quo: Tensions and Limitations	Hindrances	See p.3
	Soil only	4	3		Status quo	Status Quo: Tensions and Limitations	Hindrances	"There's only one SA soil classification system: 1977 (red), 1991 (blue), 2018 (green)"
	Soil only	5	3, 4	Inherited & modified	Status quo	Status Quo: Tensions and Limitations	Hindrances	Followed inherited outline; made own presentations
	Soil only	5	3, 4		Status quo	Status Quo: Tensions and Limitations	Hindrances	SA classification system, + comparisons to WRB (previously FAO) & USDA - for purposes of international collaboration
	Soil only	6	4, 5	Conventional assessment	Status quo	Status Quo: Tensions and Limitations	Hindrances	2x semester tests, 2 x assignments, exam
	Soil only	6			Status quo	Status Quo: Tensions and Limitations	Hindrances	Covid impact: only one assignment, project replaced practical, online exam
	Soil only	6			Status quo	Status Quo: Tensions and Limitations	Hindrances	50% exam : 50% semester (Semester test 1[30%], 2[30%]; Assignment 1[10%], 2[10%]; Project[20%])
	Soil only	6			Status quo	Status Quo: Tensions and Limitations	Hindrances	Assignment: how natural disasters affect soils; Project: immediate environment soil report (soil types, topography, human activity, land use limitations)
	Soil only	7	5	Covid challenges	Limitations	Status Quo: Tensions and Limitations	Hindrances	Urban limitations of some soil reports; assessments reweighted

Soil only	8	6	Consultation & revision	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Online: Q&A forum - students learn from each other
Soil only	9	7	SA Soil Classification Handbook (2018)	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Used as standard textbook
Soil only	9			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Taught logic of SA soil classifcaiton system - focus on field classificaiton (not additional soil lab)
Soil only	10			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Pros: Subdivision of anthrosols; Extended number of soil forms; Classification logic remains constant
Soil only	11	8	IK is fragmented & un-scientific	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Not possible to teach a system that is not formalised
Soil only	11			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK undocumented, but does exist
Soil only	12	9	Science superiour	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Science needs to validate IK for inclusion into curriculum
Soil only	12		IK is poorly defined	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	A need to research/document IK
Soil only	12		Soil science is already South African	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	SA soil classification is field based (morphological) & does not need Africanisation
Soil only	12	10	Soil science won't change	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Everyone has same soil knowledge requirements (e.g. what soil, soil capability, esosivity, sustainability, fertility)
Soil only	13	10	Practical focus	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Language barrier (of technical terms)
Soil only	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Lack of state funding - for extension officers (unemployed graduates)
Soil only	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Field training needed - difficult with massificaiton & covid/online
Soil only	13	11	Communication chalenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	In field, with small scale farmers, re scientific concepts
Soil only	15	12	SA examples	Transformation: local examples	Transformation as Local Examples	Hindrances	Local & practical examples, in local languages
Soil only	15			Transformation: local examples	Transformation as Local Examples	Hindrances	Content cannot be Africanised

	Soil only	16	12	Differet points of view valuable (ethnopedology)	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Share practical, local soil knowledge (less scientific/technical)
	Soil only	17	13	Soils & everyday life	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Practical every-day uses of soils
	Soil only	extra	15	Local publications on soil IK	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Manyevere et al
17	Curriculum only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Awareness of differing (valid) worldviews & opression from childhood
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Postgrad studies (PGCE)
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Desire to empower students (transform classroom power dynamic)
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Teacher as learner - provides motivation
	Curriculum only	1	2	Reflexivity	Personal journey	Personal and Academic Journey	Journey	Connect innter & outer worlds
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Western education paridigm lacks inner component (focused on external results/products)
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Connect to own passions/what you can offer the world
	Curriculum only	2	2	Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Deep pedagogical transformation - allows for new knowledge (Open to the unknown)
	Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Western science is reductionist & domineering (also, content over pedagogy)
	Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Hybrid western science AND other worldviews (not a binary either/or - false dichotomy)
	Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	A T&L container/structure that is open enough to provide exploration/discovery, but is also safe/held/facilitated
	Curriculum only	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Inspire/connect to students desire to learn/explore (foster learning agency)

Curriculum only	2	2, 3	Disconnect	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Underskilled teachers - a turn toward prescriptive & measurable curriculum
Curriculum only	2			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Curriculum/assessment as individualistic
Curriculum only	2			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Collaborative learning: learn content & soft skills (connect/respect others)
Curriculum only	2			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Students negate own knowledges, grief for loss of self in western university
Curriculum only	4	4, 5	Inclusivity	Connect+dialogue	Dialogue & Connection	Vision(s)	Beyond physical/scientific worldview/cerebral approach
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	(reconnect with) Intuition, felt senses, embodied knowledge
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Synergy of strengths epistemologies (beyond the binary)
Curriculum only	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Africa centred, pride in local knowledge, Africa's value
Curriculum only	5	6, 7	Openness (to)	Connect+dialogue	Dialogue & Connection	Vision(s)	Personal aspects: Practice embodied & mindfulness practices (yoga, meditation etc); other knowledges
Curriculum only	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Structural aspects: Trandisciplinarity, engage in process, kinesthetic learning
Curriculum only	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Connect within & without
Curriculum only	6	7, 8	Include other knowledges & ontologies	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Embodied knowing, elders, IKS
Curriculum only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Requires respect & humiltiy
Curriculum only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Epitemicide as self-harm (opression of western IKS)
Curriculum only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Opression as a result of fear of the unknown
Curriculum only	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Teacher becomes student

	Curriculum only	7	9	Include other knowledges	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Seek synergy between knowledges (science & IKS)
	Curriculum only	7			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Need bridge builders (dialogue, connection)
	Curriculum only	7			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Experiential learning
	Curriculum only	8	10	Disconnect	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Compartmentalization of being human (profesisonal & personal)
	Curriculum only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Humanize the university (connect with/compasison for self & other, community)
	Curriculum only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Process of openness
	Curriculum only	8	11	Include other knowledges	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Heart (passion, compassion) as mediator/motivator between knowing in the mind (west) and body (africa)
	Curriculum only	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Diversity is valuable/sustainable
	Curriculum only	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Science as inquiry, not metaphysics
	Curriculum only	extra	13, 14	Include other epistemologies	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Creative/humanities further in this process
	Curriculum only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Bridge cerebral (science) and felt worlds
	Curriculum only	extra	15	Trust other ways of knowing	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Nature's integrity = human safety
	Curriculum only	extra			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Beyond binary
18	Curriculum only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	When tutoring - really seeing the student in context/differently
	Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Senior colleague support/inspiration (dialogue with mentor)

Curriculum only	1			Personal journey	Personal and Academic Journey	Journey	Question the curriculum (see need for transformation)
Curriculum only	2	2	Transformation as process	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Slow revision - to meet current diverse students & needs
Curriculum only	3	3	Weak transformation	Limitations	Status Quo: Tensions and Limitations	Hindrances	Lip service, co-opted, status quo remains, career advancement, lack of urgency
Curriculum only	3			Limitations	Status Quo: Tensions and Limitations	Hindrances	Disconnect between theory (safe) & practice (risky)
Curriculum only	3	4	Disconnect	Limitations	Status Quo: Tensions and Limitations	Hindrances	Student's struggle to see real-world (in their lived experience) value of theory in curriculum
Curriculum only	3			Limitations	Status Quo: Tensions and Limitations	Hindrances	Students come with worldviews/IKS that are not recognised at the university (epistemic disconnect)
Curriculum only	4	5	Different ways of knowing	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	IKS in curriculum (IKS is not from the academy)
Curriculum only	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Africanisation = acknowledgement
Curriculum only	5	6	Dialogue/inclusivity	Connect+dialogue	Dialogue & Connection	Vision(s)	Engage knowledge from students, external stakeholders
Curriculum only	5			Connect+dialogue	Dialogue & Connection	Vision(s)	Need other voices to forward transformation project
Curriculum only	6	6, 7, 8	Humanising principle (ubuntu)	Connect+dialogue	Dialogue & Connection	Vision(s)	Humanising pedagogy, student as whole person with knowledge
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Mutual vulnerability, anti-competitive
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	African values, Ubuntu (unity), belonging, connection fosters meaning
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Synergy between arts (creativity) & sciences (structure)
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Covid & online - further disconnect
Curriculum only	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Currently, theory over practice

	Curriculum only	7	8	Africanise/reframe learning outcomes	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Be open to process (be open to change)
	Curriculum only	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Open structured curriculum
	Curriculum only	8	9	Disconnect	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Between theory & practice, difficult to do, lip-service/tick-box transformation
	Curriculum only	8			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Online disconnect
	Curriculum only	extra	11	A need for Africansiation guidance	Connect+dialogue	Dialogue & Connection	Vision(s)	And also accountability
19	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Experienced students' disconnect with eurocentric knowledge, vs engagement with indigenised content
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Empathy to student experience
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Familiarity fosteres learning
	Curriculum & IKS	2	1	Transformation as indigenising	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Decolonisation not possible
	Curriculum & IKS	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Documented (western) vs IKS (undocumented) knowledge
	Curriculum & IKS	2			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Indigenising connects with lived (cultural) experience
	Curriculum & IKS	2	2	Build epistemic bridges	Connect+dialogue	Dialogue & Connection	Vision(s)	Between IK & western knowledge (synergy)
	Curriculum & IKS	2			Connect+dialogue	Dialogue & Connection	Vision(s)	Multiple valid ways of knowing (not binary)
	Curriculum & IKS	2			Connect+dialogue	Dialogue & Connection	Vision(s)	University curriculum is inherntly western - can't be decolonised
	Curriculum & IKS	3	2	IKS as a network of components	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Values, beliefs, knowledge transfer, complex synergistic system

Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Culture, practices, behaviour, language, identity
Curriculum & IKS	3	3	IKS misunderstood/misrepresented	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Western lens does not see embedded (contextual) values
Curriculum & IKS	4	3, 4	Curriculum as nation-building	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Necessay to indigenise - to develop responsible (contextually fit) citizens
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Beyond qualificaitons (IKS as values, not content)
Curriculum & IKS	4			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Shared values = socially integrated society (African values, African context)
Curriculum & IKS	5	4, 5	IKS's value to science	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK's value must be seen, for science to accept it
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IKS as contextually sustainable
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Increase human knowledge (synergy)
Curriculum & IKS	7	6	Openness & respect	Connect+dialogue	Dialogue & Connection	Vision(s)	Discover value & combine knowledges
Curriculum & IKS	8	6	Respect	Connect+dialogue	Dialogue & Connection	Vision(s)	Allows dialogue
Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Desire to learn (curiosity, openness)
Curriculum & IKS	9	7	Create IKS engagement opportunities	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Schools, policy, peformance assessment, workshops, social media - increase awareness
Curriculum & IKS	10	7	Transform diversity of academics	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Few African professors (positional power)
Curriculum & IKS	10			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Diversity shifts culture
Curriculum & IKS	10			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Racial trust issues between staff (apartheid wounds)

20	Soil & IKS	extra	1	Relationship between nature & culture	Connect+dialogue	Dialogue & Connection	Vision(s)	Question deeply
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	Political agroecology
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	Critical of modern Soil Science
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	IKS & coloniality: ritual, cosmology, ontology, soil land territory
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	Ubuntu & South-South relations
	Soil & IKS	1	2	Personal journey	Personal journey	Personal and Academic Journey	Journey	PG studies; field work
	Soil & IKS	1	2	Soil as a living entity	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Holistic view
	Soil & IKS	1	2		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Reject narrow specialisation (beyond western soil classifications)
	Soil & IKS	1	2		Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Respect, humility for other than human
	Soil & IKS	1	3, 4	Science as limited	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	There is correlation between science & IK
	Soil & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Scientific universal/hegemonic worldview is self-limiting (religion-like)
	Soil & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Science: objectifies, diminishes the other, excludes, disconnects, morally irrational
	Soil & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Climate & eco-crisis a result of science's (simplistic, one-dimensional) materialist (capitalist) worldview
	Soil & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Soil science focused on static 'genetic' (regolith and up) soil classification; farmers focus on very dynamic top 1metre
	Soil & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK as fit for purpose (farmers); Soil science abstracted classification (for 'universality' which really does not work in SS, as so locally varied)
	Soil & IKS	1	4, 5	Connection	Connect+dialogue	Dialogue & Connection	Vision(s)	Rhizomatic connections, beyond geo-temporal limitations

Soil & IKS	1			Connect+dialogue	Dialogue & Connection	Vision(s)	Common sense' classification commonalities across ethnopedology knowledge systems (soil as continuum)
Soil & IKS	1			Connect+dialogue	Dialogue & Connection	Vision(s)	Soil as female; humanist/relational worldview of soil; complex & nuanced
Soil & IKS	1			Connect+dialogue	Dialogue & Connection	Vision(s)	Respect other soil worldviews
Soil & IKS	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Science as a minority, provincial knowledge system
Soil & IKS	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Science blinds itself to other knowledges & clings to power
Soil & IKS	1			Limitations	Status Quo: Tensions and Limitations	Hindrances	Science's divided (subject/object) thinking plays out in all spheres: N/S divide, Human/Nature divide, science/IKS, extractivist profit
Soil & IKS	1	6	Limits of science	Limitations	Status Quo: Tensions and Limitations	Hindrances	Major negative impacts (due to disconnected morality of the division): collapses of agro-systems, peak-oil threat, food insecurity etc
Soil & IKS	1			Connect+dialogue	Dialogue & Connection	Vision(s)	IK hotspots correlate with biodiversity hotspots (& conservation)
Soil & IKS	1	7, 8	IKS as connected	Connect+dialogue	Dialogue & Connection	Vision(s)	IK as long-term/sustainable (e.g. Dark Earths)
Soil & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue/link diverse knowledge systems (& actors) for resilience/sustainability
Soil & IKS	1	8, 9	Need to link diverse knowledges	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Diversity is robust, allows for change, locally adapted
Soil & IKS	3			Connect+dialogue	Dialogue & Connection	Vision(s)	Recover meaning, to connect with passion/motivation
Soil & IKS	3			Connect+dialogue	Dialogue & Connection	Vision(s)	Soil(land) is political - hence the disconnect
Soil & IKS	3			Connect+dialogue	Dialogue & Connection	Vision(s)	Inequalities disconnect people from each other (haves & have nots)
Soil & IKS	3	9, 10	Connection	Connect+dialogue	Dialogue & Connection	Vision(s)	Agro-ecology as an interconnected/holistic food-system (not the disconnected & problematic industrial food system)
Soil & IKS	3	10	Equality = diversity	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Inequality = lack of diversity

Soil & IKS	3	11	Connection/interdependence	Connect+dialogue	Dialogue & Connection	Vision(s)	Science divides/essentialises/fractures/disconnects
Soil & IKS	3			Connect+dialogue	Dialogue & Connection	Vision(s)	Reconnect core & periphery - foster interdependence
Soil & IKS	5	11, 12	Transition	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Transition to agroecology
Soil & IKS	5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	A political/cultural issue (beyond technical)
Soil & IKS	5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Enhance diversity for survival/transition/robustness
Soil & IKS	6	13	Create knowledge community	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Dialogue with (valued) student knowledge & desire to learn
Soil & IKS	6			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Possible virtually; created convivial atmosphere with music etc.; world café discussions
Soil & IKS	6			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Assessment: Report, symposium, attendance (no marks, pass/fail, no prescribed format)
Soil & IKS	6	16	Maximise epistemic access	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Tutor support
Soil & IKS	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Maximise diversity
Soil & IKS	6			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Lower costs, virtual, volunteer tutors & lecturers
Soil & IKS	9	17	Diversify curriculum	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Prepared readings: feminism, gender, indigenous peoples, eco-feminism etc
Soil & IKS	16	18	Ground-up policy	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Interface with local government - connect local people/projects with local govt.
Soil & IKS	16			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Connect diverse actors in dialogue
Soil & IKS	16			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Participatory education
Soil & IKS	extra	21	Beyond formal education	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Local soil maps (pragmatic, lower cost)

	Soil & IKS	extra			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Soft skills in soil science (ethnography etc)
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	Sensitivity & respect for local communities
	Soil & IKS	extra			Connect+dialogue	Dialogue & Connection	Vision(s)	Soil as not an object
	Soil & IKS	extra	22	Inclusivity	Connect+dialogue	Dialogue & Connection	Vision(s)	Dialogue, social experience
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	PG studies - desire to learn
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Engaged with local IK in field - saw exclusion/alienation by western curriculum
	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Although Africanisation can exclude other Iks (e.g. indian, San etc)
	Curriculum & IKS	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK & science share tenants: experimental, inferential
	Curriculum & IKS	1	1, 2	IK similar & different to science	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Science dismisses metaphysics of IK (Science reduces IK to its frame)
	Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	In response to marginalisation & supression of IK
	Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Foster access by inclivity of local context & learner diversity
	Curriculum & IKS	2	2	Transformation as equity & access	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Learning psychology motivations - not political
	Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Prioritize affective (values, motivations, attitudes, feelings) domain - for deep learning
	Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	IK/cultural artefacts engage multi-modal learning (embodies, situated, distributed cognition)
	Curriculum & IKS	2	3	Cognition beyond brain/logic	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Pedagogy of play
21	Curriculum & IKS	3	3	IK as contextual problem solving	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Empirical, inferential, for survival, oral

Curriculum & IKS	3	4	IK as worldview/methaphysics	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Holistic, equilibrium, respect/responsibility, metaphores
Curriculum & IKS	3	5	Epistemic equality	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Not about validating IK against western frame
Curriculum & IKS	3	6	Similarities & differences of IK & west	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Epistemic equality, respect
Curriculum & IKS	3			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Shared: empirical, inferential; Differences: holistic vs reductionist
Curriculum & IKS	3	6, 7	Foster critical thinking	Question deeply	Reflection: Questioning Deeply	Journey	Lecturers stuck in the 'known'
Curriculum & IKS	3			Question deeply	Reflection: Questioning Deeply	Journey	Pseudo science vs scientism
Curriculum & IKS	3			Question deeply	Reflection: Questioning Deeply	Journey	Learn through uncertainty
Curriculum & IKS	4	8	Africanisation as relevant curricula	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Africanisation as political or pedagogical reasons
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Epistomological access - by contextualised curricula - affective domain for deep learning
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Foster student-buy in for intrinsic motivation (PPC model - Person Process Context)
Curriculum & IKS	5	9	Marginalisation of IKS	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Some scientists deem IKS as pseudo-science; closed-minded rejection of change
Curriculum & IKS	5			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Often lip-service to IK
Curriculum & IKS	5	9, 10	IK as wisdom	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Need openness & personal journey (embodied research, out of comfort-zone, reflexivity on own worldview) to engage with IK (deep learning)
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Include diverse stakeholders to meaningfully include IK in curriculum
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Need policy & peer support for curriculum transformation

Curriculum & IKS	5	10	Transformation as process	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Wicked problem
Curriculum & IKS	5			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Science as open, curious & evolving
Curriculum & IKS	6	11	Beyond examples	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	IK examples interesting, but need problem based learning approach - fo students to see value of IK
Curriculum & IKS	6			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Needs very skilled lecturers (IK+pedagogy+dicipline) - to properly facilitate epistemological border corssing
Curriculum & IKS	7	12	Beyond examples	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Demonstrate/see/accept value of IK, to maningfully engage IK & transform own world-view (hot vs cold conceptual change)
Curriculum & IKS	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Tick-box approach (eg. CAPS curriculum) is just including IK examples
Curriculum & IKS	7			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	STEAM pedagogy approach - creative processes complement/integrate with IK (increased epistemic access)
Curriculum & IKS	8	13	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Meeningful transformaiton requires intensive self & curriculum development
Curriculum & IKS	8			Question deeply	Reflection: Questioning Deeply	Journey	Engage with (risk) the unknown, and be humble & open in learning from others (IK holders)
Curriculum & IKS	8	13, 14, 15	Authenticity	Connect+dialogue	Dialogue & Connection	Vision(s)	Authentic curiosity, authentic humiltiy, authentic engagement
Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Avoid cook-book/recipe activities - rather devise ill-structured problems
Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Self-directed & cooperative learning - increases engagement (for student & lecturer)
Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Knowledge as dynamic (science as open + IK as cooperative = interdependence)
Curriculum & IKS	8			Connect+dialogue	Dialogue & Connection	Vision(s)	Affective domain makes for deep learning
Curriculum & IKS	9	15	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Reflexivity on western perspective
Curriculum & IKS	9			Question deeply	Reflection: Questioning Deeply	Journey	Investigate similarities & differences west & IK

	Curriculum & IKS	9	16, 17	Openness	Question deeply	Reflection: Questioning Deeply	Journey	Beyond examples - inclusivity
	Curriculum & IKS	9			Question deeply	Reflection: Questioning Deeply	Journey	Engage practically (IK well-suited for this) in appropriate context
	Curriculum & IKS	10			Connect+dialogue	Dialogue & Connection	Vision(s)	Open minded scientists do engage with transformation
	Curriculum & IKS	10			Connect+dialogue	Dialogue & Connection	Vision(s)	See value in IK and educational theory - for teaching practice
	Curriculum & IKS	10			Connect+dialogue	Dialogue & Connection	Vision(s)	Ethonmathematics example - music making with boom-whackers - affective domain
	Curriculum & IKS	10			Connect+dialogue	Dialogue & Connection	Vision(s)	Teacher training a necessity
22	Soil & IKS	1	1, 2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Postgraduate studies
	Soil & IKS	1			Personal journey	Personal and Academic Journey	Journey	Curiosity, quesiton stereotypical knowledge
	Soil & IKS	1			Personal journey	Personal and Academic Journey	Journey	Experience with soil IKS - led to rejection of western binary good/bad soils
	Soil & IKS	1	2	Science limiting beliefs	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Disconnect between field and theory (gross generalisations)
	Soil & IKS	4	3	Local soil quality systems	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Broad curriculum, focused on valuing soil quality (not agro-industrial production)
	Soil & IKS	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Integrare soil science & agronomy
	Soil & IKS	4			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue with local IKS holders (who have intimate soil knowledge)
	Soil & IKS	4	4	Othering of ethnopedolgy	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Rather 'local soil knowledges'
	Soil & IKS	4			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Equality of soil knowledges
	Soil & IKS	5	5	Nurture multiple ways of knowing soils	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Beyond scientific definitions (with blind-spots)

Soil & IKS	5			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local soil knowledge, intersecting with: ecological knowledge, cropping knowledge, climate, topography
Soil & IKS	6			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Practical, in-situ assessments (incl IKS principles)
Soil & IKS	6	6	Assessment for learning	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Frequent, low-stakes, iterative assessments
Soil & IKS	7	7	Unconventional assessments are difficult to grade	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Assessment should be aligned with outcomes
Soil & IKS	7	7	Pedagogical support	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Training & faculty support/structures
Soil & IKS	9			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Students to read/prepare academic articles (not a textbook)
Soil & IKS	9	8, 9	Diverse academic readings	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Lack of ethnopedology textbook
Soil & IKS	10			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Classroom limiting, thus field trips etc
Soil & IKS	10			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Preparation intensive
Soil & IKS	10	9, 10	Experiential learning	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Virtual field trips possible
Soil & IKS	11	11	Africanisation is overdue	Tensions	Status Quo: Tensions and Limitations	Hindrances	Multiple perspectives needed
Soil & IKS	12			Tensions	Status Quo: Tensions and Limitations	Hindrances	Local scientists dismissive of local knowledge (perceived western superiority)
Soil & IKS	12			Tensions	Status Quo: Tensions and Limitations	Hindrances	Sensitise scientists to local IK
Soil & IKS	12	11	Decentre western knowledge	Tensions	Status Quo: Tensions and Limitations	Hindrances	Academics to 'border cross' between science & IK
Soil & IKS	12			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Failure (hubris) of science to acknowledge local conditions (denigrate local knowledge/peoples)
Soil & IKS	12	12, 13	Integrate solutions/interventions into local (knowledge/cultural) contexts	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Successful solutions fit local needs

	Soil & IKS	12	14, 15	Experience changes attitudes	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	IK as adaptive - but only if new knowledge (scientific) fits local needs/practices
	Soil & IKS	12			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Anthropological methods in a soil science module
	Soil & IKS	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	To value IK
	Soil & IKS	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Foster dialogue
	Soil & IKS	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Acknowledge own biases (tempting to be right & unchangable)
	Soil & IKS	13			Experience	Fit 4 Purpose & Learning Context	Vision(s)	Is a process - needs humility, openness, reflexivity
23	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Further PG studies
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Curiosity & passion for change (of staid western mindsets), social justice
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Threshold moment: encounter with anthropology, and validation of diverse epistemics/pedagogies/IKS
	Curriculum & IKS	1	2	Question deeply	Question deeply	Reflection: Questioning Deeply	Journey	Assumptions of western superiority, in education - and yet the failure/disconnect in university students
	Curriculum & IKS	1			Question deeply	Reflection: Questioning Deeply	Journey	Problamatise education as a 'product' - to fix/save global south (rather than a dialogue)
	Curriculum & IKS	1			Question deeply	Reflection: Questioning Deeply	Journey	Humility allows for shift in perspectives
	Curriculum & IKS	1	2	Diverse epistemics needed	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	IKS holders as custodians of the biosphere
	Curriculum & IKS	1			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Humble dialogue needed with IKS holders
	Curriculum & IKS	2	3	Beyond examples	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Fundemental transformation - not lip-service & 'curriculum washing'
	Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Process based (emergent) pedagogy & curriculum development

Curriculum & IKS	2			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Synergy + integration - where IKS & Science dialogue as equals
Curriculum & IKS	3	4, 5	IKS as dynamic & intrinsic to place	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK remains dynamic (not simply historical/traditional)
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK does not claim universality (all knowledges are contextual to place+history)
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK fluid/adaptable ways of knowing, rather than fixed knowledge/facts (i.e. openness)
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Western frame seeks to also make IK static
Curriculum & IKS	3			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Western frame seeks to also make IK static
Curriculum & IKS	3	6	Beyond western curriculum	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Fusion of equal epistemics & pedagogies
Curriculum & IKS	3			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Process-based experimental curriculum development/transformation
Curriculum & IKS	3			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Classroom dialogue & dynamics shape curriculum
Curriculum & IKS	3	7	Challenge the cannon	Question deeply	Reflection: Questioning Deeply	Journey	Lack of practical Africnaisaiton
Curriculum & IKS	3			Question deeply	Reflection: Questioning Deeply	Journey	Praxis and theory needed
Curriculum & IKS	3			Question deeply	Reflection: Questioning Deeply	Journey	Diversity of viewpoints for change
Curriculum & IKS	3	8	Implementation not that difficult	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Risks/atemtps (at deep transformation) need to be made - to move forward (and learn in the process)
Curriculum & IKS	3			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Academy's resistance to change, and rejection of the unknown - keeps it from tackling the wicked problem of transformation
Curriculum & IKS	3			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Single steps of transformaiton can be low-risk
Curriculum & IKS	3			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	External support matters

Curriculum & IKS	4	9, 10	Africanisation makes sense	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Logical progression - however, needs praxis
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Reverse subjugation of other/IK knowledges
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Relevance/meaning of education for lived realities/contexts of students (else alienation)
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Sustainability aims (planetary survival)
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Ubuntu values the connections/dialogue needed
Curriculum & IKS	4			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Remain critical - diverse useful epistemics
Curriculum & IKS	4	11, 12	Connection	Connect+dialogue	Dialogue & Connection	Vision(s)	Decolonisation as the will to community/connection
Curriculum & IKS	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Connecton (hybrid epistemics) for sustainability/survival
Curriculum & IKS	4			Connect+dialogue	Dialogue & Connection	Vision(s)	Local & global are inescapably connected
Curriculum & IKS	5	13	Teacher training in Africanisation	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Embed openness (to knowledges) in T&L
Curriculum & IKS	5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Include IK holders in teaching space (i.e. dialogue of knowledges)
Curriculum & IKS	5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	IK as experiential & process learning
Curriculum & IKS	5	14, 15	Show value of IK	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Logical sustainability value of IK
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Needs dialogue & humility
Curriculum & IKS	5			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	The insecurity of superiority
Curriculum & IKS	6	16	Africanisation as connected(holistic)	Connect+dialogue	Dialogue & Connection	Vision(s)	Disciplines in the Academy are siloed/disconnected (internally & externally)
Curriculum & IKS	6			Connect+dialogue	Dialogue & Connection	Vision(s)	Knowledges are inescapably interconnected, to each other & culture (in IK more obviously so)

Curriculum & IKS	6	17	Structural transformation needed	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Structures limit academic/epistemic creativity
Curriculum & IKS	7	18, 19	Inclusivity	Connect+dialogue	Dialogue & Connection	Vision(s)	Bottom-up transformation more effective/real change
Curriculum & IKS	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Seek out/include IK holders, & students' knowledges (enable agency in others) (include the unknown)
Curriculum & IKS	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Participate in dialogue requires individual agency & humility - for inclusivity
Curriculum & IKS	8	20	Epistemic hybridization	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Clarify one's own intellectual/epistemic starting point
Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue various stakeholders - ensure marginalised voices heard
Curriculum & IKS	8			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Question deeply - a creative imaginative exercise
Curriculum & IKS	9	21, 22	Clarify motives for Africanising	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Reflect on own motives/personal journey - which informs approach & process
Curriculum & IKS	9			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Beyond superficial transformaiton (Africanisaiton an ideological quesiton)
Curriculum & IKS	9			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Extrinsic vs intrinsic motives
Curriculum & IKS	9			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Have to allow for different degrees of personal transformation
Curriculum & IKS	9			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Variety of motivaitons: sustainability; fairness/social justice; relevant teaching/content; engage students; connection to place;
Curriculum & IKS	9	23, 24, 25	Epistemic hybridization	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK as: low impact, localy fit, sustainable
Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Experiment with knowledge interactions
Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Strenghts of different epistemics - multiple perspectives makes for robustness

	Curriculum & IKS	9			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	A desire to learn/widen worldview
	Curriculum & IKS	10	25	Communities of practice	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Gather & dialogue in communities of interest - for mutual learning
24	Curriculum & IKS	1	1	Desire to teach effectively	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Teach in the affective domain (feelings, attitudes, and emotions)
	Curriculum & IKS	1			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Link content & context
	Curriculum & IKS	1			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Social justice & mutual respect
	Curriculum & IKS	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Marginalised/segregated/fearfull upbringing
	Curriculum & IKS	1			Personal journey	Personal and Academic Journey	Journey	Reflected on own biases - emapthy for others - attitude shift
	Curriculum & IKS	2	2	Curriculum as social construct	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Curriculum as: propoganda, social justice, vales, content, pedagogy
	Curriculum & IKS	2			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Curriulum as equality diverse, reflects & respects students to each other
	Curriculum & IKS	2	2	Skills over content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Elected pedagogy indicates priority of content or problem solving skills
	Curriculum & IKS	3	2	IK as local	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local: tradition, lived knowledge, inter-genrational
	Curriculum & IKS	4	3	Synergize different epistemologies	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Foster critical thinking, not polarising politics
	Curriculum & IKS	4			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Respect, inclusive & safe dialogue between knowledges
	Curriculum & IKS	5	3, 4	Depoliticise concept of IKS	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	IK as: Local (not balck African); as intrinsicly cultural
	Curriculum & IKS	6	4	Hybridize knowledges	Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Seek strengthning commonalities between knowledges (IK & Science)

	Curriculum & IKS	6			Value plurality	Valuing Plurality and Indigenous Knowledges	Vision(s)	Science finds dialogue difficult, due to assumed superiority - need knowledge equality
	Curriculum & IKS	7			Connect+dialogue	Dialogue & Connection	Vision(s)	Create safe spaces, for debate/dialogue of multiple knowledges (sciences shut down dialogue i.e. right or wrong, binary)
	Curriculum & IKS	7	5	Reflexive dialogue	Connect+dialogue	Dialogue & Connection	Vision(s)	Foster critical thinking, for open-mindedness
	Curriculum & IKS	8			Question deeply	Reflection: Questioning Deeply	Journey	Acknowledge own perspective & biases, be open to other perspectives
	Curriculum & IKS	8	5	Reflexivity	Question deeply	Reflection: Questioning Deeply	Journey	Allow for action/reflection process and adaption therein
	Curriculum & IKS	9			Connect+dialogue	Dialogue & Connection	Vision(s)	Knowledge dialogue needs a safe space
	Curriculum & IKS	9	5	Safety	Connect+dialogue	Dialogue & Connection	Vision(s)	Tension in diverse perspectives - needs safe facilitaiton
	Curriculum & IKS	9			Question deeply	Reflection: Questioning Deeply	Journey	Sensitive to social leanring environment (intuition, body language, affective domain)
	Curriculum & IKS	9			Question deeply	Reflection: Questioning Deeply	Journey	Respect for others' knowing - offer dignity & openness (beyond right & wrong) - if necessary, agree to disagree
	Curriculum & IKS	9	6	Reflexivity	Question deeply	Reflection: Questioning Deeply	Journey	Identify own values & biases (surface these in classroom)
	Curriculum & IKS	10	7	Build capacity	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Overcome systemic constrains on Africanising (massification, content-driven examination etc)
	Curriculum & IKS	10			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Throughput constraints (lecturer success linked to student marks - limits teaching to content for exam success)
	Curriculum & IKS	10			Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Less content, more skills (content knowledge is not understanding)
	Curriculum & IKS	10	7, 8	Beyond content	Transformation: beyond examples	Transformation as Process: Beyond Examples	Vision(s)	Requires pedagogically trained lecturer, & much extra effort to transform within systemic constraints
25	Soil only	1			Personal journey	Personal and Academic Journey	Journey	Upbringing - farming, close to soil & nature (experiential passion)
	Soil only	1	1	Personal journey	Personal journey	Personal and Academic Journey	Journey	Realise vital importance of soil, desire to work with nature
	Soil only	2	1, 2	Further studies	Professional development	Personal and Academic Journey	Journey	Intuitive choice of soil science (from amongst agricultural courses)

Soil only	2			Professional development	Personal and Academic Journey	Journey	Career prospects & path (consulting & research experience) (privileged connections)
Soil only	3	2	Soil science small in SA universities	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Not all SA universities have a soil science degree - soil science incl. in enviro. Modules (else, SS as PG)
Soil only	3	3	Environmental Geology (1st yr)	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	
Soil only	4	3	Introduction to Soil Science curriculum	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Basic Soil: formation & genesis; properties; forming factors; classification; importance of (entirely online)
Soil only	4	4	SA classifications for different purposes	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Field: blue book; Academic: red book; Developmental: green book, PostGrad: WRB
Soil only	5	4	Inherited & modified	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	New lecturer, little module choice; Enjoying developing module
Soil only	6	5	Conventional assessment	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	2x assignments(50/50split; mostly MCQs), 1xexam(100% MCQs) - 40:60
Soil only	7	5, 6	Online (covid) assesment challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Poor internet access (resubmit&extensions); lack of fieldwork (+ experiential learning); 100% MCQs
Soil only	8	6	Online support	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Online chat support groups
Soil only	9	6, 7	No prescribed textbook	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	No textbook, due to unaffordability for students
Soil only	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Previous textbooks: Dynamic Earth: An Introduction to Physical Geology by Skinner & Porter; Understanding Earth (7th ed) by Grotzinger & Jordan
Soil only	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Students recommended to search free online resources
Soil only	10	7	Need for South African examples	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Need for textbook with practical experience of SA soils - see 'Prof Laker - Soil Science from the Heart'
Soil only	10	8	Science principles immutable	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Cannot go beyond local examples
Soil only	11	8	Dialogue	Connect+dialogue	Dialogue & Connection	Vision(s)	Collegial discussions important

Soil only	11	8	Science principles immutable	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Cannot go beyond local examples
Soil only	12	9	Local examples/classifications	Transformation: local examples	Transformation as Local Examples	Hindrances	SA soils incomprable to EU/USA
Soil only	12			Transformation: local examples	Transformation as Local Examples	Hindrances	Local solutions to local problems
Soil only	13	9	Africanise upon reccurriculation	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Easier to Africanise when curriculating from scratch
Soil only	14	9, 10	Curriculate from local perspective	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Curriculate for African students - a mind shift
Soil only	14			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Practical local examples
Soil only	15	10	No ethnopedology experience	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Understood to be cultural pedology
Soil only	15	10	Local technologies/solutions	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Archeology reveals soil erosion control structures (stone bunts)
Soil only	15			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Makes for interesting examples for students
Soil only	15	11	Create emerging farmers study groups	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Discuss (western) principles of irrigaiton & soil fertilization etc
Soil only	15	11	Emerging farmers knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Necessitated lower cost, thus more sustainable farming solutions
Soil only	15			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Working 'with' nature, avoid sterility of commercial modern farms, i.e. promote 'dirty' orchards
Soil only	15			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue knowledge exchange between emerging & commercial farmers
Soil only	16	12	Limitations of massification	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	No practicals, but a desire/need for paracticals
Soil only	17	12	Experiential learning	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Field trips important for practical experience

	Soil only	extra			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Soil science graduates go into (fertilizer/chemical) industry - Industry is commercially focused
	Soil only	extra	14	Shortage of soil science academics	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	A need for new young SA soil science academics (who will Africanise curricula)
	Soil only	1			Personal journey	Personal and Academic Journey	Journey	Poor economic upbringing - introduced to corporate bursary opportunity
	Soil only	1	2	Personal journey	Personal journey	Personal and Academic Journey	Journey	Passion since young for agriculture
	Soil only	1			Transformation: local examples	Transformation as Local Examples	Hindrances	Local examples engage students (connect to students' personal experience/knowledge)
	Soil only	1	2	Necessity of SA examples	Transformation: local examples	Transformation as Local Examples	Hindrances	Need SA soil scientists trained in what is locally relevant
	Soil only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Modernity causes of many soil problems (external disruptors)
	Soil only	1	3, 4	Local solutions suited to local problems	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Local knowledge often ignored = a lack of understanding of locality -> a need to listen to local knowledge
	Soil only	1	4	Science principles immutable	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Soil physics & chemistry the same independent of location
	Soil only	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Lack of understanding & dismissal of local context & knowledge = project failure
	Soil only	1			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Epistemic hubris
	Soil only	1	5, 6	Imposition of external/disconnected knowledge	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Creates disconnect - where locals are defensive/reject imposed knowledge
	Soil only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Watch & listen to learn (humility)
	Soil only	1			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Dialogue (respect) is needed to bridge the disconnect
	Soil only	1	6	Local soil knowledge is primary	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Support marginalised (academic) voices
26	Soil only	2	7	Job opportunity	Personal journey	Personal and Academic Journey	Journey	Discovered passion for lecturing

Soil only	2	7	Importance of varied experience	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Experience of different field work localities & institutions
Soil only	2	8	Institutional limitations	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Social justice response to students marginalised by systemic limitaiton
Soil only	2			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Entry requirements and institutional politics
Soil only	2	9	Personal compassion	Connect+dialogue	Dialogue & Connection	Vision(s)	Social justice: treat each student with personal respect, connection & compassion
Soil only	2			Connect+dialogue	Dialogue & Connection	Vision(s)	Student success linked to meaningful personal support
Soil only	2			Connect+dialogue	Dialogue & Connection	Vision(s)	Students have low confidence (due to structural marginalisation) - a need to support student confience & agency
Soil only	2			Connect+dialogue	Dialogue & Connection	Vision(s)	Students viewed as most important (rather than academic ratings etc)
Soil only	2	10	Promote African knowledge	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Challenge entrenched stereotypical Eurocentric viewpoints
Soil only	3, 4, 5	11	Generalist Soil Science undergrad	Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Lack of soil science academics
Soil only	3, 4, 5			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Need for (soil science specific [i.e. examples]) foundations in chemistry & physics
Soil only	3, 4, 5			Status quo	Status Quo: Tensions and Limitaitons	Hindrances	Also indidiciplinary experience - plant physiology, pomology, viticultural science, economic plant pathology
Soil only	3, 4, 5	12	Fit for purpose curricula	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Training to become an academic soil scienctist is not always suitable
Soil only	3, 4, 5	13	Teaching valued	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Epistemic teirs & mobility
Soil only	3, 4, 5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	University (academic) & college (technical) system cater to different needs, but mobility between is allowed
Soil only	3, 4, 5			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Requires many trained staff, reasonable teaching workload

Soil only	3, 4, 5	13, 14, 15, 16	Transformation values disconnect/mismatch	Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Teaching undervalued, niche research overvalued (e.g. NRF rating; also not research for social justice)
Soil only	3, 4, 5			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	System rewards careerism (decentres student), transformation needs student-centred compasison & attention
Soil only	3, 4, 5			Tensions	Status Quo: Tensions and Limitaitons	Hindrances	Not about lowering standards, but about (caring) sensitivity toward students' contextual circumstances
Soil only	6, 7	16	Assessment of application/problem solving	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Avoid assessment of rote learning/content retention
Soil only	6, 7	16	Experiential learning	Experience	Fit 4 Purpose & Learning Context	Vision(s)	Assessment by seminar; practical assessment (incl. fieldwork)
Soil only	6, 7	17	Massification undermines teaching & transformation	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Inadequate teaching capacity - lowers academic standards (as student centredness not possible with high student:lecturer ratio)
Soil only	6, 7	17	Specialization lacks perspective	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Specialization undermines interdisciplinary problem-solving
Soil only	8	18	Value of bridging/extended courses	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Too large a gap between (underresourced) high schools & university
Soil only	8			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Fit for purpose (dicipline tailored) bridging course
Soil only	9	19, 20, 21	Lack of local Soil Science textbook	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Red/Blue/Green/Fey books are SA classificaiton books (not textbooks/teaching aids)
Soil only	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	US/EU textbooks used in SA - lack local relevance
Soil only	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	SA soil science textbooks unprofitable (for publishers)
Soil only	9			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	University presses should publish locally-focused textbooks
Soil only	10	22	IK/local examples important	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Connect to student's lived experience/context/identity & imporoves student engagement
Soil only	10	22, 23	Reflect to avoid assumptions	Question deeply	Reflection: Questioning Deeply	Journey	Worldview and general knowledge assumptions - alienate students

Soil only	10			Question deeply	Reflection: Questioning Deeply	Journey	Check with students for understanding & sensitize to student knowledge
Soil only	10			Question deeply	Reflection: Questioning Deeply	Journey	Student/lecturer: generational, class, cultural, rural/urban, learning experiences differences
Soil only	10			Question deeply	Reflection: Questioning Deeply	Journey	Professional lecturer development - to sensitise to hidden curriculum & need to reflect
Soil only	11			Transformation: local examples	Transformation as Local Examples	Hindrances	Emphasise local conditions - to highlight/connect why it matters(relevance)
Soil only	11	23, 24	Local examples	Transformation: local examples	Transformation as Local Examples	Hindrances	Principles are universal, but local conditions/environment result in a unique manifestation thereof
Soil only	11			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Modernization ignored (local) reasons for local knowledge practices
Soil only	11			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Learn from local farmer knowledge (needs humility)
Soil only	11	25	Local knowledge integrated to local conditions	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	White & black farmers have IK/local (experiential) knowledge - passed on by word of mouth
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Academic soil science small expert audience
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Lack of incentive for accessible local textbooks and semi-popular soil science info pamphlets
Soil only	11			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Loss of undocumented intergeneraitonal and/or experiential knowledge
Soil only	11	26	Lack of accessible (soil) science communication	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	A need to document beyond scientific journal articles
Soil only	12			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	IK is connected to the local (landuse)
Soil only	12			Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Science abstracts, to 'a universal'/'principles'
Soil only	12	26, 27	IK as pragmatic	Value IK	Valuing Plurality and Indigenous Knowledges	Vision(s)	Knowledge systems have different underlying viewpoints/values
Soil only	12	27	Value the local	Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Learn from the local/sudents/IK holders

Soil only	12			Fit for purpose+context	Fit 4 Purpose & Learning Context	Vision(s)	Field experience necessary
Soil only	extra	27	Share knowledge for good	Social justice aims	Social Justice Aims	Vision(s)	University & publishers system hoard & silo knowledge
Soil only	extra			Social justice aims	Social Justice Aims	Vision(s)	Value teaching & empowering students
Soil only	extra	29	Support academic staff	Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Prioritize teaching resources & time for good curriculum prep
Soil only	extra			Transformation processes	Transformation as Process: Beyond Examples	Vision(s)	Educate lecturers about good pedagogical curriculum design
Soil only	extra	29, 30, 31	Structural challenges	Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Shortage of soil scientists in SA
Soil only	extra			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Natural sciences (vertical expert logics) dominates agricultural sciences (horizontal interdisciplinary logics) in SA
Soil only	extra			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	Disinterest in students (research over teaching)
Soil only	extra			Limitations	Status Quo: Tensions and Limitaitons	Hindrances	University manegerialism

Appendix 5.5

Ethics approval letter (ref no 2017_CAES_174)

and

Turn it in Similarity Report

CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 02/05/2019

Dear Mr Milaras

NHREC Registration # : REC-170616-051
REC Reference # : 2017/CAES/174
Name : Mr M Milaras
Student # : 62168843

Decision: Ethics Approval
Renewal after First review from
01/05/2019 to 31/10/2019

Researcher(s): Mr M Milaras
milton.milaras@hotmail.com

Supervisor (s): Dr TJM McKay
mckaytjm@unisa.ac.za; 011-670-9461

Working title of research:

Towards an Africanised soil science: The indigenization of a scientific discipline

Qualification: PhD Environmental Science

Thank you for the submission of your progress report to the CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is renewed for a six-month period, **subject to submission of the relevant permission letters and a progress report on points 1-4 below.** After six months the researcher is required to submit a progress report, upon which the ethics clearance may be renewed for another year.

Due date for progress report: 31 October 2019

*Please indicate the progress on the points below **in the next progress report:***

1. Permission needs to be obtained from the relevant gatekeepers and submitted to the Committee before data gathering may commence.
2. The project is in essence adopting a grounded theory approach; this means that changes to the methodology and participants could be made during the research. As a result the researcher is requested to provide six-monthly progress reports on the data collection and management. The reports should also stipulate the type of documents the researcher is collecting.



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3. The Committee strongly recommends that the intended questions to participants be pilot tested before data collection commences. This will assist in determining the viability of the question and approach by the researcher. Changes to the questions and sequence may result.
4. The committee is concerned about the use of the qualitative paradigm, its methods and measures to achieve data rigor. Although the researcher has made an attempt to address some of the qualitative concerns, it remains the responsibility of the supervisor and student to ensure that all qualitative data gathering, analysis, interpretation and data presentation comply with requirements of this paradigm. The committee can therefore not fully support the qualitative strategy proposed by the researcher.

*The **medium risk application** was **reviewed** by the CAES Health Research Ethics Committee on 01 November 2018 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.

7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2017/CAES/174** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,



Prof EL Kempen
Chair of CAES Health REC

E-mail: kempeel@unisa.ac.za

Tel: (011) 471-2241



Prof MJ Linington
Executive Dean : CAES

E-mail: lininmj@unisa.ac.za

Tel: (011) 471-3806

please note
the
conditions



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Appendix 6.1

Soil science curriculum – Schedule of work for lectures and practicals

Soil Science curriculum: Schedule of work for lectures and practicals

	Schedule of work Theory sessions	Schedule of work Practical sessions
Week 1	• Importance of Soil Science • Genesis of soil • Basic concepts • Basic properties of soil: ○ Structural, Chemical and soil air, soil water, soil temperature	• Sciences Librarian demonstrates online academic databases in computer lab. • During session, students look up “Soil Erosion in South Africa” articles. • Students find and save 4 – 5 citable resources.
Week 2	• Soil composition ○ Structural • Soil taxonomy (International and South African) • Overview of South African soils ○ South African soil issues	• Academic report writing session with ‘Academic Development Centre’. ○ Students develop a 2 to 3 page “Overview of Soil Erosion in South Africa”; the report must include: (1) Rates, regions and reasons for soil erosion in South Africa; (2) Socio-economic impacts of soil erosion in South Africa; (3) Environmental impacts of soil erosion in South Africa; and (4) Proper references.
Week 3	• Soil Chemistry ○ Nutrient cycling ○ Ion exchange ○ Plants and organisms	• Plagiarism lecture and exercises to raise awareness, learn how to avoid plagiarism.
Week 4	• Erosion ○ Mechanics of erosion ○ Types of erosion ○ Factors affecting soil erosion ○ South Africa and erosion ○ Basic erosion modelling	• Demonstration of how to calculate a soil erosion modelling example.
Week 5	• Soils and land use ○ Fitness of land use based on soils (construction, grazing agriculture, etc.)	• In groups students calculate erosion modelling scenarios with data provided.

	○ Soil pollution ○ Soil management ○ Fertilisers ○ Salinisation of soils ○ Human dependence on soils ○ Soils and land use in ZA	
Week 6	• Soils and wetlands ○ Gleyed soils ○ Wetlands in South Africa ○ Ecological importance	• Write up findings and conclusions. • Students write an academic report integrating: an overview of soil erosion in SA, erosion modelling calculations, findings and conclusions. • References to be included
Week 7	• Soil pollution • Soil quality and measuring • Revision	• Weathering and Erosion revision.

Appendix 6.2

Soil science curriculum – Assessment plan

Soil Science curriculum: Assessment Plan

Week	Practical		Theory	
	Description	Weight of 100%	Description	Weight of 100%
Week 1	-	-	Tutorial 1	4%♦
Week 2	-	-	Tutorial 2	4%♦
Week 3	Submit report ‘An overview of Soil Erosion in South Africa’	10%	Class test	20%
			Tutorial 3	4%♦
Week 4	-	-	Tutorial 4	4%♦
Week 5	Submit group USLE calculation done during session	20%	Tutorial 5	4%♦
Week 6	-	-	Semester Test	60%
			Tutorial 6	4%♦
Week 7	Application & reflection class test	10%	Tutorial 7	4%♦
	Submit final soil erosion report	60%		
Semester weighting	40%		60%	

*The best five of seven tutorials counted 20% of the theory mark

Appendix 6.3

Soil science curriculum – Practical assignment overview

Practical Assignment - Scientific Report - Overview

Graduate Level

2nd year level

Contents

1. Introduction

2. Literature Review

3. Methodology

4. Results

5. Findings & Discussion

6. Conclusions

7. References

Overview of
Soil Erosion in
SA
(Due 19 February)

USLE calculations
(Due in class 5 March)

Findings and
Conclusion

References

Definition, factors
ZA Rates & Regions
Causes of soil erosion in ZA:
Geomorphology
Climate
Anthropogenic

Explain the basic factors of the calculation
Show workings of USLE calculation
Provide answer with and without erosion control measure

Discuss:
The results of the calculation in terms of soil erosion in SA
Methods of soil erosion control

Full reference list for
all in line citations in
the above 3 sections

**Complete final
report due 20th
March.**

The report must be submitted in hardcopy with your name, surname and student number. You must also include a hardcopy of your final plagiarism report.

Note: Do not forget to link each section with the next, thereby creating a logical discussion of the topic.

Use sub-headings only where they add strength, structure and logic to your discussion.

Make use of the writing center, and show them this assignment guide.

Page guideline: Overview 2-3 pages; Calculations 2-3pages; Findings & Conclusions 1-2pages.

Week 3 Practical Assignment Marking Rubric

Criteria	Not achieved	Partly achieved	Almost achieved	Achieved	Achieved with distinction	Weighting	Score
Introduction to soil erosion Definition, factors ZA Regions Rates	Very poor – language needs work, ineffective, unsuitable = 0	Weak introduction, needs a lot of revision = 2	Partly effective, but language and logic needs revision = 4	Clear, effective and logical = 6 to 8	Excellent, sets the scene well, logical and effective = 10 to 12	15%	12
Causes of soil erosion in ZA: Geomorphology Climate Anthropogenic	Not addressed at all = 0	Addressed superficially = 2 to 6	Addressed part of the time = 7 to 8	Addressed much to most of the time = 9 to 10	Fully addressed = 11 to 14	18%	14
Logical discussion	No logical discussion, essay is almost impossible to read = 0 to 5	Essay is readable but needs a lot of revision and editing = 6 to 8	Discussion can be followed, needs some editing = 9 to 10	Easy to read, logical and coherent = 11 to 12	A pleasure to read, beautiful, logical, coherent discussion = 13 to 16	20%	16
Referencing: correct information that is supported with accurate referencing (incl. reference list)	No or very little evidence provided = 0 to 1	Some evidence provided 2 to 4	Part of the necessary evidence required was provided = 5 to 7	Lots of evidence provided = 8 to 9	Sound argument was backed by strong evidence = 10 to 11	14%	11
Conclusion Impacts of soil erosion: socio-economic & environmental	Very poor – language needs work, ineffective, unsuitable = 0 to 2	Weak conclusion, needs a lot of revision = 3 to 4	Partly effective, but language and logic needs revision = 5 to 6	Clear, effective and logical = 7 to 9	Excellent, wraps up the essay very well, logical and effective = 10 to 12	15%	12
Written language skills (academic English)	Many spelling mistakes = 0 to 1			Few spelling mistakes = 2	No spelling mistakes = 3	19%	15
	Ineffective, incorrect use of punctuation = 0 to 1			Good use of punctuation = 2	Excellent use of punctuation = 3		
	Weak sentence construction = 0 to 1			Okay sentence construction = 2	Good sentence construction = 3		
	Poor, weak vocabulary = 0 to 1			okay vocabulary, turn of phrase, register = 2	Good vocabulary, turn of phrase, register = 3		
	Lack of cohesion = 0 to 1			Partly coherent = 2	Coherent = 3		
Student name:					Total mark:		80
Student number:					Percentage:		
Comments:							

Final Practical Assignment Marking Rubric

Criteria	Not yet achieved	Achieved	Achieved with distinction	Weighting	Score
Introduction: An overview of soil erosion in SA	•Introduction not give a useful overview of: erosion definition, factors (soil, climate, geomorph, veg, human), ZA regions, rates, socioeconomic & enviro impacts (0 - 6)	•Introduction considers & partly discusses: erosion definition, factors (soil, climate, geomorph, veg, human), ZA regions, rates, socioeconomic & enviro impacts (7 - 10)	•Introduction discusses & explains in logical meaningful detail: erosion definition, factors (soil, climate, geomorph, veg, human), ZA regions, rates, socioeconomic & enviro impacts (11 - 14)	14%	14
Methodology: USLE shown & explained	•Methodology does not adequately explain the research methods (0 - 6)	•Methodology explains the research method, but may lack detail or clarity (7 - 10)	•Methodology explains the research method excellently & in detail (11 - 14)	14%	14
Logical discussion: Throughout essay	•The report does not follow a logical academic discusion •Points and sections do not build on each other (0 - 10)	•The report generally follows a logical academic discusion •Points and sections attempt to build on each other (11 - 16)	•The report sussinctly follows a logical academic discusion •Points and sections build and link well to each other (17 - 22)	22%	22
Referencing: correct information supported with accurate referencing & list	•Little evidence provided •Poor & incorrect referencing standards used (0 - 8)	•Significant evidence provided •Few mistakes in referencing standards (9 - 13)	•Sound argument was backed by strong evidence •Impeccable referencing standards (14 - 16)	16%	16
Findings & conclusions: Impacts of soil erosion control methods, recommendations	•Findings & conclusions are weak and poorly interrogated (0 - 8)	•Findings & conclusions show some insight & are adequatly discussed (8 - 12)	•Findings & conclusions show strong insight & investigation with adequate backing (14 - 18)	18%	18
Written language skills: Academic English	•Spelling mistakes; •Poor punctuation; •Weak sentence construction; •Weak vocabulary; •Lack of cohesion; •Inconsistent layout & formatting (0 - 6)	•Few spelling mistakes; •Good use of punctuation; •Adequate sentence construction & vocabulary; •Fairly coherent; •Few inconsistencies in layout & formatting (7 - 11)	•No spelling mistakes; •Excellent use of punctuation; •Good sentence construction & vocabulary; •Coherent; •No inconsistencies in layout & formatting (12 - 16)	16%	16
Student name:			Total marks:		100
Student number:			Percentage:		
Comments:					