Language Policy for Equity in University STEM Education in Postcolonial Contexts: Conceptual Tools for Policy Analysis and Development

Kate le Roux, Bongi Bangeni, and Carolyn McKinney

Abstract This chapter is concerned with university language policy for equity in STEM education in postcolonial contexts with diverse language landscapes. This focus is necessary, given how language acts to enable or challenge inequity in particular historical and geo-political relations, and the need for research on university language policy, specifically for STEM education, to complement research on practice. We propose conceptual tools for analysing and developing policy. We view language and STEM as historical, social and political practices and, following Hilary Janks and Rochelle Gutiérrez, equity as having two dominant meanings (*access*, *achievement*), and three critical meanings (*power*, *diversity*, *design*). We illustrate the potential use of these tools in a critical discourse analysis of the language policy of a South African university. This analysis shows a policy focus on access to and achievement in dominant STEM knowledge in 'English', with some attention to diversity and power in representations of language for STEM and the language-user. We end with five recommendations for future policy development. We position this chapter as an example of language policy analysis that responds to the specificity of context, but which potentially makes a theoretical contribution beyond the context in a way that does not universalise.

K. le Roux (✉) · B. Bangeni · C. McKinney
University of Cape Town, Cape Town, South Africa
e-mail: kate.leroux@uct.ac.za

B. Bangeni
e-mail: abongwe.bangeni@uct.ac.za

C. McKinney
e-mail: carolyn.mckinney@uct.ac.za

1 Introduction

This chapter is concerned with university language policy in postcolonial contexts with diverse language landscapes. Our specific focus is how language policy—as historical, social and political text, with material effects—may enable or constrain equity in STEM education. We use 'STEM' to include disciplines in Science, Technology, Engineering, Mathematics and Health Sciences. We propose tools for conceptualising language, STEM knowledge and equity, and demonstrate their use in a critical discourse analysis of the language policy of the University of Cape Town (UCT), an elite, historically 'white', 'English'-medium, public South African university.

In this introduction, we use the literature to motivate for our focus, and further develop this motivation in subsequent sections. Firstly, since notions of 'language', 'multilingualism' and 'science' are constructed in particular historical and geopolitical relations (García & Lin, 2018; Makoni & Pennycook, 2007; Prah, 2017), there is a need to attend to the context-specificity of language policy for STEM. We write *from a postcolonial context*, recognising that such contexts are themselves diverse and changing. Historically, 'language' and Euromodern 'science' were part of the "cultural kitbag" (Bishop, 1990, p. 58) of colonial practices—and education in particular—that constructed inequities, for example, through their use to distinguish different groups of people according to their 'worth' on a hierarchy (Bishop, 1990; Glissant, 2010). We illustrate this point in our description of the South African context in Sect. 4. Given the enduring dominance of colonial languages, both locally and globally, postcolonial universities seeking to avoid (re)producing language inequities need to (a) interrogate how history shapes current language policy and practice, and with this understanding (b) fundamentally rethink inherited conceptions and experiences of language to transform physical and knowledge spaces (Cele, 2004; Makoni & Pennycook, 2007). Exploring language for equity in university STEM in such contexts requires a concept of equity that is more sophisticated than considerations of access to and success in the dominant knowledge using historically dominant languages.

Secondly, there is a need for research specifically on language *policy*, to complement research on *practice*. Cases of 'multilingual' practice in university courses in South Africa, including in STEM (e.g. Dalvit, 2010; Leeuw, 2014; Madiba, 2019) have been reported. Yet research (e.g. Cele, 2004; Kotzé, 2014) and policy (Department of Higher Education and Training [DHET], 2020) identify a lack of progress in reshaping the language landscape of South African universities. This literature proposes political, economic, social, linguistic and managerial reasons for poor policy implementation. While these arguments cannot be disputed, there is growing recognition that language policy itself needs to be problematised, evidenced by detailed case studies of institution-specific language policy (e.g. Nudelman, 2015; van der Merwe, 2016), as well as in South African students' calls for 'free decolonised education' voiced in protest action since 2015 (e.g. Gillespie & Naidoo, 2019). These protests and recent scholarship (e.g. Luckett, 2016) suggest that efforts to transform South African universities need to look beyond institutional structures, to

the wider Euromodern and neoliberal ideologies that underpin institutions such as UCT. Language ideologies, specifically, have been the focus of recent scholarship on language policy and practice in South African schooling (e.g. Makoe & McKinney, 2014; McKinney, 2017), and we extend that work to *university language policy.*

Thirdly, there is a need to focus on language policy for university *STEM* education. Drawing theoretically from the sociology of education and social semiotics, scholars have identified differences in the nature of knowledge and language use across broad fields of 'Science', 'Social Science' and 'Humanities', as well as between disciplines (e.g. Dalvit, 2010; Kuteeva & Airey, 2014). Writing from a European context, Kuteeva and Airey (2014) use these differences to argue for disciplinary-specific language policies. Yet there is a need to explore what such a policy might look like in postcolonial contexts. In South Africa, policy development can be informed by a growing body of work on the intellectualisation of named African languages in quantitative disciplines such as computer science, economics, mathematics, psychology and statistics, and its use in university classrooms (e.g. Dalvit, 2010; Madiba, 2014, 2019; Mkhize et al., 2014; Paxton, 2009; Whitelaw et al., 2019).

To respond to the three needs identified here, we propose—as described in detail in Sect. 2—a particular conceptualisation of language and STEM knowledge as intricately related to power in social practices. We view language policy as historical, social and political text, related to other texts such as institutional strategic plans and national university language policy. Drawing on Hilary Janks (2010) and Rochelle Gutiérrez (2002, 2012), we adopt a five-part notion of equity, comprising *access*, *achievement*, *power*, *diversity* and *design.* These conceptual tools can be used to ask how language policy in a postcolonial context may enable or constrain equity in university STEM education. Specifically, this involves answering sub-questions about how policy text:

- represents 'language', 'multilingualism', and 'STEM knowledge', and their relations;
- identifies the purpose and location of language use;
- identifies the language-user;
- constitutes and locates the 'language problem' to which policy responds;
- constitutes the solution to the problem and
- asserts its status at the institution.

In this chapter, we use the case of language policy at UCT to illustrate the use of our conceptual tools to answer these questions. The chapter is structured as follows: We describe and motivate for our conceptual tools (Sect. 2), describe our methodological approach to the case (Sect. 3), locate the case in the context of postcolonial South Africa (Sect. 4), apply our tools to analyse UCT policy (Sect. 5) and conclude by demonstrating how an analysis such as this can inform language policy development (Sect. 6).

2 Conceptual Tools

2.1 Conceptualising Language and STEM Knowledge

Policy falls between ideology and practice (Shohamy, 2006, cited by van der Merwe, 2016). Thus, to understand what is identified as the 'language problem' to which policy responds, the ideologies of language and STEM knowledge that underpin policy need to be identified. By ideology we mean "the sets of beliefs, values and cultural frames that continually circulate in society, informing the ways in which language [and knowledge] is conceptualized as well as how it is used" (Makoe & McKinney, 2014, p. 659). We distinguish two broad conceptualisations of language and STEM knowledge in the literature.

Firstly, STEM knowledge may be viewed as objective, neutral, bounded and fixed, and thus universal and transferrable unproblematically across contexts. Mathematics is an excellent example making it an ideal base for scientific knowledge; in mathematics 'truth', what counts as mathematical knowledge, is intrinsic to the logic of the discipline and judged by the rigour of proof, and thus it can represent the essence of all things in an objective manner (Bishop, 1990; Skovsmose, 2016; Gutiérrez & Dixon-Román, 2011). Similarly, if language is regarded as neutral, unitary, bounded and stable, it can be viewed as an object that can be standardised in lexical and grammatical rules. Thus, language can 'carry' fixed STEM meanings across contexts. This *monoglossi*c ideology normalises the naming of languages such as 'English' or 'isiXhosa', and as 'first'/ 'second' languages, the practice of 'code-switching', and 'multilingualism' as the adding of named languages (Makoni & Pennycook, 2007; McKinney, 2017). García and Lin (2018) refer to the last-mentioned as *elite multilingualism*, as distinct named languages are hierarchised. A monoglossic ideology informs the naming of language as 'scientific'/ 'everyday' (Tyler, 2016), as 'developed'/ 'undeveloped' for science, and for those languages that are 'developed', the view that scientific ideas can be unproblematically translated across these languages. This perspective of language normalises monolingualism, and locates the 'language problem' in the 'multilingual' student who is not 'proficient' in the 'standard', dominant, named language for STEM.

A second approach views STEM disciplines as historical, social and political practices involving identifiable combinations of knowledge, activities, technologies, social relations, values, identities and language use (Fairclough, 2003). Here, language has an ontological, epistemological and relational function in STEM. So, the focus of this perspective is language use by people in practice (in 'translanguaging'), language as changing and developing in use (Finlayson & Madiba, 2002), and language as *heteroglossic*, that is, "the complex, simultaneous use of a diverse range of registers, voices, named languages or codes" which form part of a multimodal repertoire for meaning-making in a particular context (McKinney, 2017, p. 22, following Bakhtin, 1981). This ideology normalises *indigenous multilingualism*, that is, how the majority of people in postcolonial contexts grow up using and continuing

to use various named languages flexibly (García & Lin, 2018). Here, the 'multilingual' student uses a rich repertoire of language practices in different roles and contexts. Language policy is historical, social and political text, that works ideologically to produce what is 'normal' language use at university, and has material effects.

From this perspective, the named languages and 'science' of postcolonial contexts are 'invented' in coloniality, that is in dialectical, asymmetrical interaction between colonisers and the colonised. Historically, European languages were drawn on to codify indigenous language use in writing as named, bounded languages (García & Lin, 2018; Makoni & Pennycook, 2007), and a binary has been produced between '(Euromodern) science' and 'indigenous knowledge'. 'Euromodern science' in colonial languages was constructed as authoritative and learned, and used as a tool for governmentality.

2.2 Conceptualising Equity

Equity is often used interchangeably with 'fairness', 'democratic access' and 'justice', as distinct from 'inequality' as 'sameness' of opportunities or outcomes (Gutiérrez, 2002; Pais, 2012), and also as in tension with 'excellence' and 'quality'. We propose a five-part concept of equity that draws from scholarship in contexts of language diversity: Janks' critical literacy and Gutiérrez's sociopolitical perspective of mathematics education. The five meanings are not new. Yet we demonstrate in this chapter that, taken together, they respond to a recognised need for a nuanced concept of equity that brings into view, in a particular context, not just certain groups or individuals but the system itself and the underpinning ideologies (Gutiérrez, 2002; Pais, 2012).

Our five-part concept of equity has two dominant meanings: language use for *access* to, and *achievement* in the dominant STEM knowledge. Gutiérrez (2012) suggests these are about "playing the game" (p. 21) in the current status quo. *Access* is commonly viewed as "opportunities to learn" in the form of "tangible resources" such as good teachers, and quality curriculum and learning materials (p. 19). Yet viewing equity in education as a didactical issue has not yielded much gain (Pais, 2012). In a study of mathematics education for Health Sciences in South Africa, le Roux and Rughubar-Reddy (forthcoming) argue for a broader notion of access. Firstly, *formal access* to academic programmes by meeting language and STEM entrance requirements, to financial support for tuition and living costs, and to safe accommodation and productive learning spaces. Secondly, *epistemic access* (or *epistemological access* for Morrow, 2009) to the valued STEM knowledge in the dominant language of teaching, learning and assessment (LoLT). This includes being listened to by influential audiences (Janks, 2010, citing Bourdieu, 1991), and being heard when using language to ask questions and to demonstrate one's learning. Lastly, *social access* is "the possibility to inhabit a space to an extent that one can say, 'This is my home. I am not a foreigner. I belong here'" (Mbembe, 2016, p. 30).

The second dominant meaning of equity, *achievement*, is about student success in the dominant STEM knowledge in the LoLT, as measured in course taking patterns, assessments, accreditations and participation in the "pipeline" (Gutiérrez, 2012, p. 19).

The three critical meanings of equity are about challenging a language and knowledge status quo that (re)produces asymmetrical power relations, and reshaping or "changing the game" (Gutiérrez, 2012, p. 21). Firstly, *power* (or *domination* for Janks) is about recognising language and STEM knowledge as historical, social and political practices and, in postcolonial contexts, 'disinventing' dominant conceptions to understand their historical constitution and (re)production in contemporary times (Makoni & Pennycook, 2007; Mbembe, 2016). The second critical meaning of equity is *diversity* (or *identity* for Gutiérrez) which acknowledges different ways of using language, and related STEM knowledge and identities. But not all notions of 'diversity' are critical, for if knowledge, language, identity are seen as fixed, enumerable objects, differences may either be hierarchised or used in a form of romanticised plurality that reinforces domination (Janks, 2010; Makoni & Pennycook, 2007). However, if language, knowledge and identities are seen as practised and hence changing—including a view of indigenous languages as growing as languages of science (Finlayson & Madiba, 2002)—then diversity is a productive resource for change.

Yet it is not enough to disinvent dominant views of language and STEM knowledge, or to identify in diversity better descriptions thereof, hence the third critical meaning, *design*. This involves destabilising what is 'normal', expanding what counts as legitimate language use for STEM, and recognising new meanings as necessary in a contemporary, postcolonial world (Janks, 2010; Makoni & Pennycook, 2007).

Crucially, all five meanings are interdependent and equally important for equity. For "changing the game requires being able to play it well enough to be taken seriously" (Gutiérrez, 2012, p. 21). This tension leads to an unavoidable *access paradox* (Janks, 2010) in postcolonial contexts. For example, if we provide access for all to the dominant STEM knowledge in a colonial language, this contributes to maintaining the dominance of these forms, and the potential for design presented by diversity is not realised. Yet if we do not support students to access the dominant forms, we perpetuate historical asymmetries in a society that continues to recognise only these forms.

3   Methodology

3.1   A Case Study of Language Policy

The language landscape of the 26 public South African universities, South Africa and other postcolonial contexts is diverse and changing. Yet, our choice of a case study of one university—in particular UCT which is an elite, 'English'-medium institution with a strong and enduring colonial legacy, as described in Sect. 4—has value in two

respects. Duminy et al. (2014) argue that the case study in a postcolonial context offers "nuanced" (p. 10) knowledge for local practice and policy, but can also "bring back" (p. 3) traditionally periphery contexts for wider theoretical contributions. Thus, our intention in this chapter is to offer a contribution that neither essentialises the local case, nor claims universality.

3.2   A Critical Discourse Analysis of UCT Language Policy

UCT developed its first language policy in 1999, with revisions in 2003 and 2013. A new policy is in progress. Thus, in this chapter we analyse the most recently published 2013 Policy (UCT, 2013a) and the related Draft Implementation Plan (UCT, 2013b),[1] acknowledging their production at that time in UCT's history. In the absence of a more recent published policy, we search in more recent institutional and faculty planning texts for signs of current thinking about language that might inform an upcoming policy.

We analyse these policy documents using Fairclough's (2003) method of critical discourse analysis, which is aligned with our conceptualisation of language as described in Sect. 2. From this perspective language policy text is dialectically related to the wider historical, social and political practices in which it is located. On the one hand, the text gives meaning to or constitutes 'language', 'knowledge', the 'language-user' and so on. On the other hand, policy text is itself shaped by "circumstances, histories, trajectories, strategic positions and struggles within these contexts" (Fairclough, 2006, p. 167).

Fairclough's (2003) method of critical discourse analysis involves working to-and-fro between three levels of analysis. At the micro-, sentence-level of *description,* we perform a content and linguistic analysis of the texts. We analyse the lexical and grammatical choices (such as nouns and adjectives for naming languages and language-users, verbs and modality for the policy tone), the order and extent of coverage of ideas, and the warrants for claims to legitimacy. At the meso-level of *interpretation,* we look across the texts to ask, What meanings are present/absent? What meanings are foregrounded/backgrounded? At the macro-level of *explanation,* we consider how the texts might be shaped by the wider context; we look for traces of the conceptualisations of 'language', 'knowledge' and so on available in the wider context, and described in Sects. 2 and 4.

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[1]The Draft Implementation Plan (UCT, 2013b), developed by the Language Policy Sub-committee (LPC), was provisionally approved by the University Senate Teaching and Learning Committee, subject to costing. This Plan was made available for this analysis by LPC member Carolyn McKinney.

4   The Context of the Case of UCT Language Policy

4.1   *Language and STEM in Education*

Formal colonial rule by the Dutch and then the British from 1652 to 1948 set in place particular racial, social, economic, knowledge and linguistic hierarchies in South Africa. Education for the colonisers, not the indigenous peoples, was prioritised, with mission schools educating a small black African elite in 'English'. UCT, founded in 1829, has since 1928 been located on land bequeathed by the British imperialist Cecil John Rhodes. The language 'Afrikaans' was developed from Dutch, with Portuguese, Indonesian, Malay and local Khoisan influences. Colonisers codified named African languages such as 'isiXhosa' in written form in genres such as religious but not scientific texts.

During apartheid (1948–1994) colonial hierarchies were entrenched legally, spatially and institutionally. Education for students legally classified as 'white' was provided in a student's 'home' language of either 'English' or 'Afrikaans' (with the development of Afrikaans as an academic and scientific language prioritised), and focused on knowledge, including STEM, for academic and skilled labour. For those classified as 'black African', policy dictated named 'African' languages as the LoLT in primary schools, with a switch to 50–50 'English'-'Afrikaans' in high school. STEM knowledge was not regarded as necessary for those being schooled for unskilled labour.

The interaction between this sociopolitical history, modernity and neoliberalism presented a newly democratic South Africa with multiple challenges such as redressing past injustices, developing an inclusive, democratic nation and meeting local social and economic needs in a competitive neoliberal, globalised world. The 1996 constitution recognises 11 named, 'official' languages: 'Afrikaans', 'English', 'isiNdebele', 'isiXhosa', 'isiZulu', 'Sepedi', 'Sesotho', 'Setswana', 'siSwati', 'Tshivenda' and 'Xitsonga'.

Twenty-five years into democracy, the UCT student population is more diverse racially and linguistically, as measured by self-declared apartheid racial classification and 'home' language. Yet UCT continues to grapple with its strong and enduring colonial legacy, recognised in its dominant Euromodern, 'white' and 'English' institutional and knowledge structures. Student protests since 2015 highlight how historically marginalised students feel they do not belong in such spaces (Gillespie & Naidoo, 2019). Research on STEM achievement at UCT shows that proficiency in 'English' matters in complex interplay with race, class, geography and schooling (e.g. Rooney, 2015).

The pipeline to achievement in university STEM needs to be understood in the context of schooling; the majority of school students study STEM in a language they are not proficient in. Less than one-sixth of South Africans report using 'English' inside or outside of the household (Statistics South Africa, 2019). Yet the school curriculum promotes an early exit model of 'bilingualism' from 'home' language as

LoLT in Grades 1 to 3 to 'English' or 'Afrikaans' as LoLT in Grade 4 (McKinney, 2017), and the subject 'English Additional Language' is cognitively undemanding (Kapp & Arend, 2011).

4.2 Language Policy in South African Universities

South African Universities are required to develop their own language policies and implementation plans, in line with the constitution and national policy. The first national Language Policy for Higher Education (LPHE) was gazetted in 2002 (Ministry of Education, 2002). A revision was gazetted in 2020 (DHET, 2020), for implementation in 2022.

The two policies are similar in the following respects: "equity" is used alongside "equality" and "fairness" (DHET, 2020, p. 13) to refer to "official", named languages being used at "multilingual" universities; both recognise the political nature of language in South Africa, language as a "barrier" to university access and success, and the need for resources to develop indigenous languages; and both implicitly suggest a tension between working within and challenging the status quo.

Yet the two policies differ, firstly, in that the 2002 LPHE offers more space—in the short term—for working within the "status quo" (Ministry of Education, 2002, p.10) to support students to learn in the colonial languages as LoLTs, while also "promoting" (p. 14) 'multilingualism' for institutional transformation. The development and use of named indigenous languages—a medium-term to long-term goal (pp. 3–4)—for "equity" and "redress" is balanced against "practicability" and individual constitutional "rights". In contrast, the revision represents indigenous languages as "meaningful academic discourse" (DHET, 2020, p. 9), and important for "cognitive and intellectual development" (p. 5).

Secondly, the 2002 LPHE makes one reference to "academic literacy" (Ministry of Education, 2002, p. 11) in the LoLT and does not recognise disciplinary-specific literacies. The revision defines "academic language" as having "discipline-specific vocabulary, grammar, punctuation, argumentation and discourse" and "rhetorical conventions" (DHET, 2020, p. 7) and stresses the potential of indigenous languages to function as "sources of knowledge in the different disciplines of higher education" (p. 9). Lastly, there is a shift in where the 'language problem' is located and hence the tone of each policy. The 2002 LPHE uses a language of "encouragement" (Ministry of Education, 2002, p. 15) in "promoting" (p. 14) multilingualism and developing indigenous languages. Yet the 2020 policy shows a level of frustration with universities for not giving indigenous languages "the official space to function as academic and scientific language" (DHET, 2020, p. 9). Thus, it prescribes what universities "must" do, and the need for government monitoring and evaluation.

5   Critical Discourse Analysis of UCT Language Policy for Equity in STEM

5.1   UCT Language Policy (2013)

The substance of the 1.5 page Policy (UCT, 2013a) is on page one. Three, numbered objectives are identified: (1) the development of "multilingual proficiency and awareness"; (2) the "development" of all South African languages for use in instruction, and "promotion" of scholarship in these languages and (3) ensuring that "students acquire effective literacy in English", defined as "the ability to communicate through the spoken and written word in a variety of contexts: academic, social, and professional". Objective one, as the "starting point", locates the 'language problem' in the student who "needs" to "acquire" such proficiency and awareness, with "multilingualism" having "personal, social and educational value". Later the problem is also located in the university's internal and external communication.

The naming of 'English' as the "primary" LoLT suggests the possibility of other LoLTs, while still foregrounding 'English'. Overall, the Policy establishes rather than problematises the *power* of "literacy" in 'English', that is, an ideology of language as monoglossic and of Anglonormativity. 'English' is named with certainty ("English *is*…", our italics) as "the primary language" of teaching and examination "at all levels" (except in language and literature departments) and of governance and administration, and is an "international language". Thus, "educational value" lies in 'English', with *achievement* in 'English' necessary for degree purposes and for participation in a global pipeline. Students need to "acquire effective literacy in English" for *epistemic access*, and university communication in 'English' should be "clear" and "concise" to enable *physical access* for all. Although students need "the spoken and written word" in English in "academic, social, and professional" contexts, reference to the *diversity* of language use in disciplines and the visual and symbolic modes for STEM knowledge is absent. Consistent with national LPHE, UCT Policy is less prescriptive on objectives one and two, than on objective three; academic staff are "expected" to "explore" ways to achieve the former; objective two is a "medium- to long-term" goal; and all three "official" languages of the region—'English', 'isiXhosa' and 'Afrikaans'—are to be "promoted" for communication and used "where practical".

Unlike national LPHE, the Policy does not represent ongoing support for literacies in 'English' as in tension with the development and use of other named languages. The word "multilingual" is used many times, but predominantly as an adjective for "proficiency" and "awareness", and the "social" and "personal", and not "educational", value thereof is developed, that is, for "participation in society". This is an elite multilingualism that should run in parallel to 'English' at UCT. The presence of many staff and students for whom 'English' is not the "primary language" is noted, but this is represented more as a problem than a resource. Language *diversity* is used uncritically to refer to the presence of multiple named languages in the university

and society, rather than as a heteroglossic practice for disciplinary meaning-making. Thus, the need and potential for *design* in the sense of challenging the status quo is not surfaced in the Policy.

5.2   UCT Draft Language Policy Implementation Plan (2013)

Our analysis of the 19-page draft Plan (UCT, 2013b), developed by a Language Policy Sub-committee, suggests that it fulfils its mandate to provide strategies, timelines, responsibilities and funding requirements for the 2013 Policy implementation. Importantly, the Plan makes discursive moves that shift this Policy conceptually.

The Plan (UCT, 2013b) renames and re-orders the Policy objectives: (1) "Academic Literacy in English Strategy" (the original "Literacy" renamed), (2) "Multilingualism Strategy" and (3) "Promote Scholarship in African languages (isiXhosa)" ('Afrikaans' not named). These are linked to the constitution, the 2002 LPHE emphasis on "multilingualism" for "equity of *access* and *success* for all students" (our italics), and to UCT's commitment to *diversity* in the sense of "social justice and democratic values" (p. 1). The first two objectives are identified as "main objectives" which are "essential graduate attributes" (p. 1) for student *achievement*. Initially, the two objectives are represented in tension ("on the one hand […] and on the other […]", p. 1), but they are subsequently named as "intertwined and complement[ary]". Their relations are given meaning in the notion of a "continuum" of a student's "*language and literacy repertoire*" (p. 1, italics in the original). This is defined as "the range of languages and varieties that a person uses to perform particular roles and tasks", with an example for one student provided (Table 1).

The notion of "repertoire" extends the *diversity* of language, challenging the dominant narrative of named languages; language is contextual (used in "clinical" settings and "scientific reports"), includes reading, and languages are not "separate distinct linguistic codes" (p. 2).

The Plan focuses first on a student's "Academic Literacy in English". Drawing legitimacy from international and local scholarship, language is represented as "central" for university learning (p. 2). Indeed, it is here that the initial textual reference to "equity" is developed, with language "cut[ting] to the heart of UCT's equity goals" (p. 4). Again, language *diversity* is expanded: the focus is on "a new variety of language", that "embodies" disciplinary knowledge, values and forms of expression,

Table 1   Representation of a student's "language and literacy repertoire" (UCT, 2013b, p. 2)

Formal curriculum			*Informal interaction*
Academic literacy in English	Multilingualism for learning	Multilingualism for professions	Multilingualism for interaction
e.g. Scientific report, essay, MCQ, thesis	e.g. glossaries	e.g. clinical case histories	e.g. isiXhosa conversation classes

and includes "digital literacies and numeracy" (p. 2). It notes that given the historical and current *power* asymmetries, the use of English as LoLT at UCT "shapes an individual's chances of success" (p. 2). Thus "Academic Literacy in English" is recognised as necessary for *access.*

Describing the 'language problem' and its solution in the section "Academic Literacy in English", the Plan expands the discourse on who needs language support and further expands on *diversity*, while still noting the Anglonormativity of the institution. Support for "throughput and equity" for those named as English Additional Language ("EAL") students should continue, but should be extended to "local and international" students at "key transitions" in both undergraduate and postgraduate degrees (p. 4). "Educational disadvantage" is extended to include "students from better resourced schools" (p. 2), since schooling in general is not considered as preparation for university learning. Also, differences across faculties and between "the workplace and university" (p. 3) require that disciplinary lecturers "embed academic literacy in faculties across the degree process" (p. 4).

The Plan groups the remaining three aspects of a student's repertoire illustrated in Table 1 under objective two, "Multilingualism Strategy". The claims in this section are given legitimacy by references to examples of existing practice and institutional statistics on language diversity. Firstly, "multilingualism for learning" establishes that languages other than 'English' can be used for learning in "formal" spaces. Glossaries, "multilingual study material" and "multilingual tutors" can support "concept literacy" for *epistemological access* to and *achievement* in disciplines such as "mathematics" and "statistics", and fields such as "Humanities", "Science" and "Health Sciences" that have specialised language use (p. 6).

The second multilingual strategy, to be planned at faculty level, involves all students in professional degree programmes "tak[ing] at least one semester course in an African language" (p. 7). This strategy shifts the 'language problem' to monolingual English students, but only those in professional programmes, illustrated by practice in Health Sciences. This strategy is "urgent" (p. 7) for *achievement*, given external pressure from professional and educational accreditation bodies and government. The final two multilingual strategies foreground *diversity* of named languages for *social access* on campus; "multilingualism" to "enhance social interaction" (p. 8) in "informal contexts" requires "communication" courses in 'isiXhosa' and 'Afrikaans', and "multilingualism for transforming the institutional environment" (p. 8) requires institutional communication in 'English', 'isiXhosa' and 'Afrikaans'.

While promoting these four multilingual strategies, the Plan identifies financial and human resource constraints and difficulties making "space" (p. 6) for African language courses in Health Sciences curricula. "Multilingual study material" (p. 6) should be made available online, but *power* asymmetries in *physical access* to digital technology are not surfaced.

The Plan names the third Policy objective, the development of 'isiXhosa' for learning and scholarship, as a "requirement" of national LPHE, and reproduces the national and institutional policy language of "promotion", given the financial, human and structural constraints (p. 9). Importantly, the aforementioned STEM-specific examples of glossaries and tutorials are noted as contributions to the necessary

language development. Yet the Plan identifies a need for *physical access* for further development; building capacity for this work requires a structural pipeline to and funding for an undergraduate major and postgraduate study in 'African' languages.

Thus, the 2013 Plan responds to its mandate, while also developing two critical meanings of equity. University language use is *diverse,* involving a range of identities and context-specific use socially, professionally and academically, and at all levels of study. Disciplinary-specific language use is noted, but most importantly, examples presented are from STEM. Reading and digital literacies are recognised language modes, but the visual and symbolic modes for STEM learning are absent. Who needs support is extended beyond the "EAL" student, while recognising the need for ongoing support for the "EAL" student, given the *power* of 'English' in the Anglonormative space. Yet given its Policy mandate and relatively minimal detail on indigenous language intellectualisation, the Plan is limited with regards to challenging the dominant use of named languages. Hence possibilities for language and knowledge *design* are not developed.

5.3 UCT Vision and Strategy Since 2013

In the absence of an updated, published UCT language policy, we turn to more recent institutional and STEM Faculty level vision and strategy texts. We acknowledge that these texts were not developed specifically as language policy, but we are interested in references to language.

The institutional Strategic Planning Framework (UCT, 2016) for 2016 to 2020 mentions language in two of the five goals, with action not prescribed. Firstly, building "a new inclusive identity" (p. 10) is about *social access* to UCT, with the presence on campus of a *diversity* of named languages, together with different religions, cultures, political views and so on, given significance. This includes the use of indigenous languages along with attention to artworks and building names. Secondly, for "innovation in teaching and learning", language, culture and experience are "resources" which should be "recognised" and "utilised" (p. 30), a hint at their use for *epistemic access* and *design.* Monolingual 'English' students need to expand their language use; they should be "encouraged" to "acquire communicative competence" in a South African indigenous language and to learn "other major world languages", "especially" those used elsewhere in Africa (p. 31). The UCT 2030 Vision, currently a discussion document (UCT, 2020), makes one reference to language in its recognition of the institution's history as an "English-speaking colonial university". It seeks to value its "Afrikan roots" (p. 5), the intentional naming "Afrika" asserting the agency of the continent. The institution has a "dream" to draw on its "social and cultural diversity" (p. 7) and to contribute locally and globally. Thus, attention is given to geography, and not language, in identifying the university community and its relevance.

We focus next on the Faculty of Engineering and the Built Environment (EBE) (n.d.) Strategic Plan for 2017–2020, and the Faculty of Health Science (2015) "work

in progress" Vision for 2030. Staff and student *diversity* for *social access* focuses variously on racial and gender categories, culture, values and epistemology. EBE identifies "multilingual" signage and letterheads, and staff participation in conversational 'isiXhosa' as necessary for "inclusivity" (p. 1). EBE suggests "differential entry targets" for students (p. 4), and the Faculty of Health Sciences wants undergraduate and postgraduate intake to "meet the needs of the country" (p. 4). This could include language, since the latter Faculty currently does recognise school credits in a named 'African' language in undergraduate admissions. Regarding the nature of STEM knowledge, curriculum in EBE should be "inclusive, relevant and contextual" (p. 4), and clinical work in Health Sciences needs a "patient-centred approach" (p. 10). Yet across these texts, the role of *diverse* language resources for learning and knowledge production is absent.

6 Conclusions and Recommendations

We began by arguing that language policy analysis for equity in STEM education requires conceptual tools that respond to the specificity of context, but which also potentially make a theoretical contribution in ways that do not universalise. Writing from a postcolonial context requires tools that recognise how notions of 'language' and 'STEM knowledge' are constructed in particular historical and geo-political relations of coloniality and global neoliberalism, and conceptualise equity as more than access to and achievement in the dominant knowledge using historically dominant languages. We have used the case of language policy at UCT to illustrate how our proposed tools bring into view how policy may enable or constrain equity in that context. To conclude, we summarise this analysis and then illustrate, in the form of recommendations, how this knowledge can inform policy development.

Our analysis suggests that the discourse on language in the 2013 UCT texts largely focuses on 'English' for *epistemic access* to and *achievement* in dominant STEM knowledge. Elite multilingualism, for which space has to be made, mainly signals *diversity* for *social access*. Yet, importantly, the 2013 Plan develops two critical meanings of equity, in particular by expanding the perspective on language, who needs language support, and how indigenous language might be used for *epistemic access* to dominant knowledge taught and assessed in 'English'. Crucially, the Plan identifies disciplinary-specific language use not only in 'English' but also in indigenous languages, exemplified in use in STEM. Yet there are limited opportunities for working with the concept of *design* in the sense of expanding what counts as language use for producing STEM knowledge.

We argue that the discursive shifts made in the 2013 Plan, ongoing on the ground STEM language practice, and the new national policy provides the push and space for a revised UCT policy that attends to all five, interrelated meanings of equity. Thus, we end with five contributions to this future policy development that might also be considered in other contexts of language diversity.

Firstly, language policy itself needs to be recognised as historical, social and political text, that works ideologically, and has material effects. So policy, and not only practice, can (re)produce or challenge inequity. This text needs to act at institutional level, but also faculty and disciplinary level, and intertwined with other policy and strategy at these multiple levels.

Secondly, language policy development can be informed by the five-part notion of equity exemplified in this chapter. Crucially, attention to the three critical meanings involves challenging the *power* of monoglossic ideologies of language by offering a heteroglossic perspective of all language use as practice that changes and develops in use and functions ontologically, epistemologically and relationally, and language as multimodal (including the visual and symbolic modes for STEM). This also involves challenging the dominance of 'English' as the language of learning and scholarship, by drawing on existing work on the intellectualisation of indigenous languages for use in STEM.

Working at the level of ideology facilitates a move from seeing language *diversity* as an elite multilingualism for *social access*, to a critical view of heteroglossic language use and indigenous multilingualism as a resource for *social* and *epistemic access* to dominant knowledge and also for *design* of STEM knowledge. Indeed, attention to *power* and *diversity* from a critical perspective shifts the definition of the 'language problem' from the student who is not 'proficient' in 'English'. For it draws attention to possibilities of *design* in the form of the related processes of 'reinventing' language in the sense that indigenous languages develop through their use (Finlayson & Madiba, 2002; Mkhize et al., 2014), expanding what counts as legitimate language use for STEM, and building new, quality meanings as relevant in a contemporary, postcolonial world (Makoni & Pennycook, 2007).

Development of the three critical meanings strengthens the concept of *access* for equity. So rather than multilingualism acting symbolically in the service of *social access*, it is viewed as acting to build both identity and knowledge for *achievement* in quality, locally and globally relevant STEM knowledge. For *physical access*, student admissions in all STEM faculties and staff recruitment and selection must value indigenous languages. Not only does this raise the status of these languages, but it creates space for these languages to develop in their use in teaching and learning, and in scholarship (Finlayson & Madiba, 2002; Mkhize et al., 2014).

Attention to staff recruitment and selection is important for our third recommendation, which is for the university to take seriously whose voices contribute to policy development (Antia & van der Merwe, 2019), both in terms of what language repertoires but also what disciplines are represented.

Fourth, we argue that policy needs to act at multiple levels. As noted, it has to act at the macro-level of ideology and at the level of STEM disciplines, drawing on language scholarship in these disciplines for legitimacy. Importantly it needs to work from the ground up with practical examples of the use of indigenous 'African' languages in STEM. Certainly, we have many promising examples of the process of intellectualisation of indigenous languages in South Africa. This includes dynamic and ongoing translation processes for glossaries in economics, mathematics and statistics (Madiba, 2014) and psychology (Mkhize et al., 2014). It includes examples

of how glossaries and translanguaging practices can be integrated into university classrooms to promote both *epistemological* and *social access* in these disciplines (Madiba, 2019; Mkhize et al., 2014; Paxton, 2019; Whitelaw et al., 2019), and in computer science (Dalvit, 2010), while simultaneously furthering intellectualisation of the languages through their use. We also have examples of how attention to indigenous languages contributes to the *design* of new knowledge in astronomy (Leeuw, 2014), computer science (Dalvit, 2010) and psychology (Mkhize et al., 2014). There is also a growing body of work in South Africa focusing on multimodal STEM language use, including the visual and symbolic modes; in earth and life sciences (Paxton et al., 2017), civil engineering (Simpson, 2015) and engineering dynamics (Le Roux & Kloot, 2020).

Finally, we argue that the development of policy as discursive text as proposed here needs to be seen as acting materially with other resources, both financial and human. For example, the institution could offer collaborative education teaching and learning grants involving disciplinary and language experts working on the ground with visible policy text.

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Kate le Roux is Associate Professor in Language Development in the Centre for Higher Education Development, University of Cape Town, South Africa. Her research is located at the intersection of language, mathematics and the learning of disciplinary knowledge in science and engineering. This focuses on equity, power and identity, drawing theoretically from critical linguistics, critical mathematics education, multilingualism and multimodality for learning, and Southern Theory. She was a 2014 Mandela Mellon Fellow at the Hutchins Center for African & African American Research, Harvard University, USA.

Bongi Bangeni is Associate Professor in Language Development in the Centre for Higher Education Development, University of Cape Town, South Africa, and a Mandela Fellow at the Hutchins Center for African & African American Research, Harvard University, USA. She has published on writing and identity, black students' language attitudes and their transitions from undergraduate to postgraduate studies. She is co-editor of the book Negotiating Learning and Identity in Higher Education: Access, Persistence and Retention (2017, Bloomsbury) which forms part of the 'Understanding Student Experiences of Higher Education' series.

Carolyn McKinney is Associate Professor in Language Education at the University of Cape Town, South Africa. Carolyn's teaching and research focuses on language ideologies; multilingualism as a resource for learning; critical literacy and the relationships between language, identity/subjectivity and learning. She recently published Language and Power in Post-Colonial Schooling: Ideologies in Practice (2017, Routledge) and is a member of the bua-lit language and literacy collective: http://www.bua-lit.org.za/.