https://doi.org/10.34024/prometeica.2024.31.16375

(IM)MOBILE LANGUAGES AND LITERACIES IN MATHEMATICS EDUCATION

THINKING ABOUT KNOWLEDGE MAKING FROM AND FOR THE RELATIONAL, GEOPOLITICAL SOUTH

LINGUAGENS (I)MÓVEIS E LITERACIAS EM EDUCAÇÃO MATEMÁTICA

Pensando sobre produção de conhecimento de e para o Sul Geopolítico e Relacional

LENGUAJES Y ALFABETIZACIONES (I)MÓVILES EN EDUCACIÓN MATEMÁTICA

Pensar la producción de conocimiento desde y para el Sur Geopolítico y Relacional

Kate le Roux
(University of Cape Town, South Africa)
kate.leroux@uct.ac.za

Recibido: 25/02/2024
Aprobado: 30/10/2024

ABSTRACT

My focus in this conceptual paper is the choice of theoretical concepts and their place-based use analytically for knowledge making about languages and literacies in mathematics education. This is motivated by two related concerns: that the pursuit of certainty, stability, and permanence of meaning of analytic concepts brings some, and not other, existences into being; and that concepts are given meaning in relational, geopolitical place in enfolded pasts, presents, and futures. I write from and for my context in the relational geopolitical South, a context pervaded by questions of what knowledges and practices, for whom, and using what languages and literacies. I propose an imaginary of the world as an archipelago of geopolitical contexts. This is a complex world in which openings and closings, mobilities and permanencies, continuities and discontinuities, entanglements and separations, and incompleteness of languages and literacies and their meanings are the norm, rather than a problem. I argue for a shift in thinking; from the student as language migrant, to flows and fractures in meaning in space and time. For it is in these (im)mobilities that inequities emerge, but also in which the potential for redesign lies. I offer this place-based thinking to prompt conversations about the concepts-in-use in other contexts, towards strengthening knowledge making in mathematics education, without universalising.

Keywords: languages. literacies. mathematics education. mobility

RESUMO

Meu foco neste artigo conceitual é a escolha de conceitos teóricos e seus usos situados analiticamente para a produção de conhecimento sobre linguagens e literacias em educação matemática. Isto é motivado por duas preocupações que estão relacionadas: aquela em que a busca da certeza, estabilidade e permanência dos significados dos conceitos analíticos trazem para algumas existências do ser, e não outras; e aquela em que aos conceitos são atribuídos significados em lugares geopolíticos e relacionais, nos quais passados, presentes e futuros estão entrelaçados. Eu escrevo do e para meu contexto geopolítico e relacional do

Sul, um contexto permeado por questões de quais conhecimentos e práticas, e para quem, usam quais linguagens e literacias. Logo, proponho uma imaginação dos mundos como um arquipélago de contextos geopolíticos. Este é um mundo complexo no qual aberturas e fechamentos, movimentações e permanências, continuidades e descontinuidades, enredamentos e separações e, incompletudes das linguagens e literacias e seus significados são a norma, e não um problema. Argumento, então, para uma mudança no pensamento; do aluno como um migrante linguístico, para fluxos e fraturas de significados no espaço e tempo. Pois nessas (i)mobilidades, desigualdades emergem e, também, uma potência para redesenhar linhas. Assim, ofereço esse pensamento situado para promover conversações a respeito dos conceitos-em-uso em outros contextos sem universalizá-los, para reforçar uma produção de conhecimento em educação matemática.

Palavras-chave: linguagens. literacias. educação matemática. mobilidade

RESUMEN

Mi enfoque en este documento conceptual se centra en la elección de conceptos teóricos y su uso basado en el lugar analíticamente para la construcción de conocimiento sobre idiomas y alfabetizaciones en la educación matemática. Esto es impulsado por dos preocupaciones relacionadas: que la búsqueda de certeza, estabilidad y permanencia del significado de los conceptos analíticos da origen a algunas existencias, y no a otras; y que los conceptos adquieren significado en un lugar relacional y geopolítico en pasados, presentes y futuros entrelazados. Escribo desde y para mi contexto en el Sur geopolítico relacional, un contexto plagado de preguntas sobre qué conocimientos y prácticas, para quién y utilizando qué idiomas y alfabetizaciones. Propongo una imaginario del mundo como un archipiélago de contextos geopolíticos. Este es un mundo complejo en el que las aperturas y cierres, las movilidades y permanencias, las continuidades y discontinuidades, los entrelazamientos y separaciones, y la incompletitud de idiomas y alfabetizaciones y sus significados son la norma, más que un problema. Argumento a favor de un cambio en el pensamiento; desde el estudiante como migrante lingüístico, hasta flujos y fracturas de significado en el espacio y el tiempo. Porque es en estas (im)movilidades donde surgen las inequidades, pero también donde reside el potencial para el rediseño. Ofrezco este pensamiento basado en el lugar para fomentar conversaciones sobre los conceptos en uso en otros contextos, hacia el fortalecimiento de la construcción de conocimiento en la educación matemática, sin universalizar.

Palabras clave: lenguajes. alfabetizaciones. educación matemática. movilidad

1. Prologue: Island thinking about the (language) migrant

An Island, by South African author Karen Jennings (2020), was one of thirteen novels longlisted for the United Kingdom-based Booker Prize. Jennings wrote the novel having just moved from South Africa to Brazil, and feeling physically, socially, and linguistically isolated (Jennings, in Jennings & Malec, 2022).

The central character in the novel, Samuel, has lived alone for over twenty years on a small island which he does not own, off the coast of an unnamed African country. He feels in control of this space, with a sense of having buried his past in this country, from colonisation, to independence, and then dictatorship, and of being unaffected by contemporary politics. Others, in the form of nameless, lifeless bodies that wash up on the island, move into his space regularly, but he simply buries these, too. One day, however, he cannot bury one such 'body' – named 'the man' in the novel – which is still breathing. In the absence of a shared written and spoken language, they communicate using looks, murmurs and gestures, as Samuel reluctantly nurses 'the man' (Attwell, 2021). Samuel struggles to categorise him: A migrant? A refugee? A friend? An enemy? Since Samuel knows nothing about 'the man', he can only see an object,

"the other", who is "certainly nothing like [Samuel]". Thus, "it is much easier to hate him" (Jennings, in Hitchens & Jennings, 2021). Samuel finds that he cannot bury his past. Jennings challenges the reader: To what extent will a person go to maintain their assumed closings, permanencies, discontinuities, separations, and completeness? Who is rendered unremarked in this process, and with what implications?

2. Introduction

Languages and literacies have long been a focus of Mathematics Education and Society (MES) scholarship, given their centrality to knowledges, cultures, places, identities, relations, and values. I use *languages* broadly for registers, modes (e.g., words, talk, symbols, images, actions), genres, discourse practices, named language codes (e.g. 'English', 'isiXhosa'), dialects, and accents. *Literacies* are our actions with languages in context: writing, reading, talking, looking, listening, drawing, and using (quantitative) information, and technologies (le Roux et al., 2022). My focus in this paper is the choice of theoretical concepts and their place-based use analytically for knowledge making about languages and literacies in mathematics education. This focus is motivated by related concerns. Firstly, like Jennings' character Samuel, as scholars we tend towards categorisation. We use inclusion/exclusion practices that bring 'objects' into existence, rendering some existences and the relations of production "unseen and unremarked" (Green, 2020, p. 15). We strive for certainty, stability, and permanence of meaning, over time and space, in tightly bounded, fixed conceptual tools, and methodological units of analysis, all of which involve choices about what to hold stable (Kell, 2006; 2015). Then, like Samuel, equipped with our apriori categories, we gaze from our context, not only (re)describing vertical, 'global' spatial imaginaries of the world that reify and correlate knowledges, peoples, languages, and places, but also (re)inscribing certain materialities (Kell, 2017).

There is a growing, yet certainly not new, chorus of voices within the social sciences – including in mathematics education scholarship on languages and literacies (e.g., Barwell, 2016; le Roux & Swanson, 2021) – problematising our 'sedentary', 'universal' conceptual tools. These voices ask to what extent the supposed stability may be a function of the immobile tools we have chosen to characterise phenomena that are "raw, dynamic and emergent" (Kell, 2006, p. 127, citing Appadurai, 2000). They ask from what 'place' our thinking is produced, reminding us that all concepts are given meaning in the folding of pasts, presents, and futures in geopolitical place, in relations of authority, collaboration, inclusion/exclusion, etc., with other contexts (Connell, 2007). For example, I write from Africa, a continent of historical and contemporary entanglements between peoples, knowledges, practices, and languages:

> … a deeply heterogenous world of flows, fractures and frictions, accidents and collisions […] New boundaries are emerging, while old ones are being redrawn, extended, or simply abandoned. The paradoxes of mobility and closure, of entanglement and separation, of continuities and discontinuities between the inside and the outside, the local and the global, or of temporariness and permanence. (Mbembe, 2021, pp. 12-13)

This is the relational world that the arrival of 'the man' on Jennings' island shows cannot be buried and controlled, and which Samuel is forced to confront. It is a world in which I am entangled, and must confront in my positionings as a scholar at the University of Cape Town (UCT). This is an elite, historically 'white', English-medium, public university with a stated commitment to national, continental, and global relevance, which is located in a deeply inequitable South Africa. Located in the interplay of languages, literacies, mathematics, and mathematics-in-action in science and engineering, my scholarship is given meaning in and informs my collaborative education development practice with disciplinary lecturers at UCT. Pervading these collaborations are pressing questions: What knowledges and practices, for whom (student, society, the Earth), and using what languages and literacies? How might we work with dominant discourses to enable access to currently powerful knowledges in English? But also, against such discourses to critically understand this power and to explore the reach of historically buried languages and literacies and their meanings towards redesign?

In this conceptual paper, I share and motivate my developing thinking towards place-based conceptualisations that may be productive for pursuing these questions. I draw on scholarship of thought leaders who think from the relational, geopolitical South, but in conversation with thinking from other contexts. I use the collective term 'relational, geopolitical South' for empirical similarities in the conditions and experiences of the political, economic, spatial, and ecological precarity, (re)constituted in enduring asymmetrical relations of global colonialities (Bhan, 2019). This includes experiences of the traditionally marginalised in the geopolitical North. My thought narrative may appear "certainly nothing like" (Jennings, in Hitchens & Jennings, 2021) those in other contexts represented in the MES community. Yet Gqola (2021, citing Mistry & Schuhmann, 2015) reminds us that "stories are nomadic", that is, "in the stories of others who are superficially nothing like ourselves" (p. 44), we can "make sense of something outside of the story itself" and "through empathy, recognition, and illumination" (p. 45), imagine ourselves as connected to others, and indeed new ways of being. I offer this thinking with the intention of engaging in conversations about the concepts-in-use in other contexts.

Since I view all knowledge as place-based, I begin by sketching the context that gives meaning to my work, acknowledging that this is itself a selective process. I explore what conceptual tools may be available for my thinking about languages and literacies in mathematics education in this context, and then describe my imaginations and empirical work in progress. I end with an epilogue, a story that differs from the island narrative with which I commenced.

3. The relational geopolitical South context from and for which I think

Contemporary Cape Town, the second most populated South African city, covers an area of approximately 300km^2 from the slopes of Table Mountain. Most photographs of the UCT campus invite a reading of its striking, physical place on these slopes. For the speakers of the 'Khoesan' language, who resided in this region for thousands of years, the mountain is a "prevailing weather, a settlement, and a mountain where rock, cloud, the creator, rains, streams, and fresh growth are one" (Green, 2020, p. 27). Entanglement, involving both coexistence and conflict, between these speakers and users of other African languages in the area began around the first century, followed by entanglement between Indigenous peoples and Anglo-European peoples from the late fifteenth century (Arndt, 2022). These last-mentioned encounters saw the start of centuries-long (re)production of fixed, tightly bounded, hierarchically-ordered physical and conceptual categories of natural resources, spaces, peoples, knowledges, languages, and educational opportunities, which were central to controlling nature, certain peoples, and their flows. These objectification processes included the privatisation of land and water in legal rights, and the construction of physical hedges, fences, and military and other buildings made with mountain rock (Green, 2020). Indeed, these processes gifted 'ownership' of land on the Table Mountain slopes to British imperialist Cecil John Rhodes, who in turn bequeathed it for the building of the current UCT campus.

Languages and literacies were central tools in this colonial expansion (Arndt, 2022; Glissant, 1997; García & Lin, 2018). This involved the dominant denotational codes of Anglo-European languages – framed as monolingual, with their multilingual origins masked – migrating into this context. In a long, complex interaction between Indigenous language speakers, missionaries, educationists, intellectuals, and colonial leaders, these codes were used to construct tightly bounded, fixed, homogenous, standard named, written languages, such as isiXhosa, and Setswana (Arndt, 2022). This included bringing into existence categories of people who spoke these languages and burying, rendering unremarked, the dynamic, fluid heterogenous local language practices, as well as the beings, knowledges, and pasts, presents and futures of the Indigenous users of such practices (Arndt, 2022; Ashcroft, 2014). And the hegemonic status of written, standard, 'scientific' English was established.

During apartheid, from 1948, colonial era hierarchies were solidified legally, spatially, and institutionally. Related linguistic, racial, and ethnic classifications were used to divide peoples, and to decide whose movement was forced and controlled, or not. On the Cape Peninsula, this took the form of

the forced removal of peoples not legally classified as 'white' from the nourishing Table Mountain slopes to the sandy Cape Flats. State resources were directed to schools reserved for so-called 'white', English- or Afrikaans-speakers, such as the schools located on the higher contours of the Peninsula, close to Table Mountain. Afrikaans is a codification as a 'scientific' language of colonial era creole languaging practices that emerged over four centuries of entanglement between the Dutch, Portuguese, Indonesian, Malay and Khoisan. Mathematics was considered important in the preparation of 'white' students for academic and skilled labour (Khuzwayo, 2005). In contrast, in under-resourced schools on the lower contours, the Cape Flats, mathematics was backgrounded in the preparation of students for unskilled labour. For 'black African' students, named African languages were prescribed for instruction in primary school, with a switch to 50/50 English/Afrikaans in high school.

In the democratic transition, from the 1990s, legal and policy changes aimed to dissolve hierarchies and to weaken related spatial, social, linguistic, and education boundaries. For example, the 1996 South African Constitution enshrines equal rights to basic education, and assigns equal status to 11 languages, including nine named African languages. Policy declares schools open to 'all races' and promotes multilingualism. The grade 1 to 9 mathematics curriculum is framed as 'for all', and offers a choice of the subjects Mathematics or Mathematical Literacy for grades 10 to 12.

Yet thirty years into formal democracy, the historical marks of difference endure; in my context of work, the contours of the Cape Peninsula mark not only geological and ecological differentiated elevations, but also enduring material and symbolic racial, racial, socio-economic, knowledge, linguistic, and educational hierarchies. Most students bring rich linguistic repertoires and hence a "three dimensional […] way of knowing the world" (Anonymous, 2018) to school and university classrooms:

> I speak Sepedi. Sometimes I speak Sepedi to those who know Tswana and Sotho. Then I speak isiZulu to those who know Zulu and Xhosa. Then I speak English to those who speak English. […] If one of us doesn't know the language, I speak in English. (University student, Mogau, cited in le Roux et al., 2022)

Yet, accessing opportunities to learn 'powerful' mathematical knowledge – given meaning in formal mathematics register, written and symbolic modes, discourse practices of defining, proving, etc., in English – requires students to move vertically up contours. And this requires burying their 'local' (Blommaert, 2010), heterogenous languages and literacies, knowledges, and identities. Not doing so, renders the migrant student, like Jennings' fictional character 'the man', silenced:

> In my [school mathematics] class our class teacher forced us to speak English. So I was […] comfortable with English. But it also comes to a point if you have a really core question that you want to ask in your home language and you can't say English that hurts because you want to keep them in. (University student, cited in Shay et al., 2020)

Indeed, crucially, continuing to use the latter renders the student 'locked in' (Blommaert, 2010) to 'local', home and community registers, oral and embodied modes, daily languaging practices, named African languages, dialects and non-standard accents of the lower contours. And again like 'the man', this student is viewed as a problem, a crisis. There is ample evidence in South Africa that this exclusion begins at an early stage of mathematics education. For example, policy prescribes a switch from mother tongue instruction in grade 3, to English (or Afrikaans) for content subjects in grade 4. While school mathematics teachers may harness students' diverse language repertoires for learning, English remains the language of power. Thus, the majority of students are learning mathematics in a language there are still learning. Some schools may not offer the subject Mathematics in grades 10 to 12 (a prerequisite for quantitative disciplines at universities), with a recent marked decrease in this option at schools on the Cape Flats (Govender, 2023). Only 12% of students who start school will pass either Mathematical Literacy or Mathematics in grade 12. Three-percent of schools (including those on the upper slopes of Table Mountain, close to UCT) produce more Mathematics distinctions than the rest (Spaull, 2019), with UCT a select study destination of these high-performing students. Yet statistics show that only those scoring at least 90% at school achieve the (quality) pass signaling a successful navigation of the vertical contour from school to first-year mathematics at UCT (Shay et al., 2020), with students commonly not recognising any flow between contours:

> I think for me it was just not grasping the concept. It would be there, and it would say, this is this is this, and I'm like okay, fine. But I don't understand. I just don't get it […] Because it felt like, even the maths that I knew in high school was null and void now. […] I would show a friend […] and they'd be like, 'No, but it's a special triangle, you know your special triangles, you know your angles. […]'. And then I would ask myself, how did you even think about incorporating that? (University student, cited in Shay et al. 2020)

In addition, performance in first-year mathematics at UCT is inequitable, by categorisations of declared racial classification and home language, and performance in school English and tests (in English) of 'academic literacy' (Shay et al., 2022). Students with diverse language repertoires report various difficulties using languages and literacies for learning first-year mathematics: listening to lecturer talk (including the accent); reading university textbooks; navigating a wide range of learning resources; asking questions in English; and learning mathematics "in fulltime English".

The slow violence (Nixon, 2011) of these linguistic and related ontological, epistemic, and social injustices, are the focus of ongoing UCT student activism (e.g. #RhodesMustFall), which highlights barriers of access to dominant discourses, but also questions the relevance of these discourses and challenges the slow pace of transformation thereof.

4. Trends in thinking about languages and literacies in mathematics education

I turn now to my search for conceptual tools for my scholarship in this context. Again, I acknowledge that selections are required for a paper of this length, and refer the reader to the references for more detail.

Within mathematics education, the decades-long strengthening and maturing of our conceptualisations, from and for various contexts, including South Africa, of the complexity of languages and literacies in mathematics education are well documented (e.g. Barwell, 2016; Morgan, et al., 2014). This spans from viewing languages and literacies – specifically, written language with particular lexical and grammatic features – as neutral, decontextualised, transferable 'skills', residing in the minds of individuals; to a situated, social practice perspective of multimodal languages and literacies as resources for learning mathematics; to recognising that language is always political. Yet much of this thinking uses a monoglossic ideology (Barwell, 2016); we 'see' only closed, permanent, standardised languages and literacies – relative to written, formal mathematical language in hegemonic languages – and related homogenous users, knowledges, classes, ethnicities, and nationalities. This is well exemplified in our nouned language such as 'first/second/third language', 'English additional language learner', 'everyday/formal mathematical language', and a language as 'developed/undeveloped' for science. From such a perspective, 'multilingualism' refers to the (asymmetrical) stacking up of language codes, or monolingualisms (Makoni & Pennycook, 2007; McKinney, 2017), an 'elite multilingualism' in García and Lin's (2018) terms.

Mathematics education scholars are increasingly thinking about languages more fluidly, informed by a heteroglossic ideology (Barwell, 2016). Commonly following Bakhtin (1981), languages and literacies are viewed in terms of repertoires of registers, modes, discourses, named language codes, and accents in situated use for meaning making. While geopolitical North discourses of 'superdiversity' (following Vertovic, 2007) have prompted this shift in thinking, the complexity of society and related language use brought into view by this concept is certainly not new in geopolitical South contexts (Arndt, 2022; Makoni & Pennycook, 2007).

Blommaert's evolving work, which has been used in mathematics education (e.g. Barwell, 2016; Staats & Laster, 2019), signals a shift from thinking about the language migrant to the (im)mobility of languages in contexts of entanglement. Stated briefly, Blommaert (2010) conceptualises a simultaneous layering of (a) languages and literacies, and (b) contexts in time and space. While all contexts have specific language and literacy norms ('orders of indexicality'), power asymmetries exist between orders: the 'local' scale, is situated, varied, momentary; whereas the 'translocal' scale, is universal, uniform,

timeless. Languages and literacies in the latter, a "voice from nowhere" (Prinsloo & Krause, 2019, p. 161, citing Silverstein, 2014) can move and 'jump', unproblematically projecting into other scales. Local voices, "from here and there" (Prinsloo & Krause, 2019, p. 161, citing Silverstein, 2014), may recontextualise powerful languages and literacies, but lack function to travel beyond a local.

Blommaert (2021) describes his concepts as 'imaginative', that is, for creating thinking about the world. Canagarajah (2017) identifies as the key affordances of this thinking for geopolitical South contexts, its attention to the complexity of language and literacies flows, and how power works therein. This, Canagarajah (2017) argues, challenges dominant discourses of globalisation as representing a single language and literacy norm, and as a 'flattening' of a world absent of inequity. However, as with all the concepts discussed in this section, it is the extent to which such thinking tools are developed analytically, and their subsequent application in specific contexts where my and other's related concerns about knowledge making lie (e.g. Blommaert, 2021; Blackledge et al., 2016; Canagarajah, 2017; Kell, 2006).

Firstly, is the concern that, like Jennings' character Samuel, our categorising processes (even unintentionally) evoke thinking that lends supposed closings, permanencies, discontinuities, and separations. This has the potential to naturalise and reify the vertical stacking of closed, homogenous languages and literacies, and (correlated) peoples, knowledges, and places. This prompts the use of categories deterministically, for example, viewing certain languages and literacies (and their users) as 'locked in' to a local, and thus a problem, a crisis, and a threat to the translocal (Canagarajah, 2017). Thus, we bury the historical and contemporary entanglement of all locals, including how lower scale languages and literacies may project into higher contours. We bury language users' knowledge of the different norms and their agency (Canagarajah, 2017). This tendency in our thinking helps to explain why concepts such as 'multilingualism', 'linguistic diversity', 'translanguaging', 'superdiversity', and 'scale-levels' may not yield our hoped-for gains towards reducing inequity (Blackledge et al., 2018; Canagarajah, 2017; Kell, 2017; Ndhlovu, 2016; Prinsloo & Krause 2019). For this thinking prompts simply inserting new, 'natural' categories of (homogenous) ethnicities and nationalities, including the 'migrant', into the existing stratified contour model. Thus, we may promote the value of the local at higher contours for the purposes of inclusion and belonging therein, rather for its meaning potential. And we miss how different norms are entangled in the same space, and the contestation and renegotiation that takes place therein (Canagarajah, 2017).

Secondly, Kell (2015) alerts us to how, as researchers, we cast a gaze from the seemingly elite, homogenous, scholarly, 'upper' contour into which languages and literacies move (or not). This, rather than listening in the contexts from which the languages move. As Ahmed (2007) reminds us, the work our concepts do depends on who gets to use them, from where, and for whom. Again, we are reminded of the fictional character Samuel; if we do not share a language we cannot 'see' the other.

To work against our tendency towards closings, permanencies, discontinuities, and separations, we need detailed, situated empirical work on (im)mobile languages and literacies in which we "keep our constructs open to accommodate norms being creatively renegotiated in diverse social spaces, and the possibilities of new norms that are collaborative (Canagarajah, 2017, p. 36). Indeed, Canagarajah (2017), Kell (2006), and Blommaert (2010) share examples of such work in various contexts in Cape Town. Specifically, Kell (2006) argues against taking as a unit of analysis a 'slice' of time, a social practice, a context, or an event. Rather, starting from the contexts from which languages and literacies move, she proposes following the meaning-making trajectories in a sequence of events within and across contexts in which people act and "make things happen" (Kell, 2008, p. 892). I move next to one possible imaginary for my relational, geopolitical South scholarship.

5. Thinking from and for the related geopolitical South towards (im)mobile languages and literacies in mathematics education

The thinking about languages and literacies in mathematics education in this section – inspired by relational geopolitical South thinking – aims to move away from an imaginary in which the language

migrant moves into and is viewed from the 'island', the 'upper contour'. Following Glissant (1997), I propose a view of the 'world' as an archipelago of geopolitical contexts, each with individual and collective knowledges and agentive peoples, and in which languages and literacies have function for meaning making. This view of contexts and their languages and literacies is not an "act of disconnection or separation […] by which one cuts oneself off from the world" (Mbembe, 2021, p.89), nor an anything goes relativism of contexts. It is not a romantic mosaic of contexts, each with bounded languages and literacies, for the purposes of 'inclusion', for example, by simply inviting oral storytelling. Rather, it is a world that cannot be systematised, a "deeply heterogenous world of flows, fractures and frictions, accidents and collisions" (Mbembe, 2021, pp. 12-13) between contexts and languages and literacies with particular meaning-making functions therein. These contexts are related in the entanglement of pasts, presents, and futures, relations and their power relations that cannot be buried. It is also a world in which peoples, knowledges and related languages and literacies move, "in predictable and unpredictable ways" (Nyamnjoh, 2020, p. 13). This world is "like a mask dancing. If you want to see it well you do not stand in one place" (Nyamnjoh, 2020, pp. 12-13, citing Achebe, 1974). This, since every geopolitical context is incomplete, is "always composite, open-ended" and "in need of relationships with others (beings, things, ideas)" (Nyamnjoh, 2020, p. 12, citing Tutuola, 1952; 1954). Crucially, incompleteness, change, movement, and uncertainty are neither problems, nor characteristics of some, but intrinsic to being in relation to and needing relations with others. As the fictional character, Samuel, discovers, he cannot function alone.

It is in these flows, fractures and frictions as languages and literacies and their meanings move (or not), that power is at work and in which inequities and injustices emerge (Kell, 2006). It is the openings and closings, mobilities and permanencies, continuities and discontinuities, entanglements and separations, and incompleteness, that I, as a scholar, need to listen for in my empirical and analytic work. For these signal opportunities for mediation (Kell, 2006) towards working with dominant discourses for access, *and* for working against such discourses towards redesign (Christie, 2005).

I am currently exploring the potential of this imaginary analytically. Located in a collaborative curriculum redesign project at UCT that focuses on the school to first-year university mathematics transition as contextualised in section 3, this research aims to inform the design of a "pedagogy of shuttling" (Canagarajah, 2017, p. 49) between contours. Starting from the 2023 academic year, students who choose to enrol in a new first-year calculus course, structure their Science degree programme so as to 'make space' for more time on mathematics in their first year. These students attend lectures and tutorials – characterised by a traditional, content-driven approach – with students carrying a full, first-year course load, but also attend twice-weekly workshops. These workshops aim to recognise the mathematics knowledges, identities, languages, and literacies of the students, and create opportunities for learning and using the discourse practices regarded as necessary for university mathematics, such as defining, proving, looking for patterns, and problem solving. Since we view languages and literacies as central to accessing, learning, and demonstrating understanding of mathematics, these discourse practices are infused in and made explicit throughout the workshops. We create opportunities for students – individually and in small groups – to move between using various language codes and modes, literacies, and the technologies therefore. In my linguistic ethnography, using course materials, observations, and student 'talk-around text' discussions, I aim (following Kell, 2006) to trace the meaning-making trajectories across the course, and within the workshops, as lecturers, tutors and students act to "make things happen" (Kell, 2008, p. 892). I ask: Where are the openings and closings, mobilities and permanencies, continuities and discontinuities, entanglements and separations, and incompleteness? Where is the symbolic violence, or the agency of participants? With what implications, for whom? And, crucially, where might mediation that focuses on students' resources, not deficits, be needed?

I certainly do not underestimate the complexities of this task, and not just on account of the spatial and temporal scope of research such as this. But in consideration of the deep-seated epistemological 'cage' (Greer & Skovsmose, 2012) in which resides my thinking about the nature of mathematics and mathematics education research and their practices. And also on account of my positionings in the

context: for it is those on the upper contours of the academy, of mathematics education – the monolingual, formal mathematical "voice from nowhere" (Prinsloo & Krause, 2019, p. 161, citing Silverstein, 2014), the 'Samuels' – who have long gazed into onto other contours, rendering various languages, literacies, and related mathematical knowledges (il)legible. Certainly, the possibility for further symbolic violence remains, even if the proposed archipelagic imaginary offers the potential for redesign of this gaze. Yet, "think we must" (Haraway, 2016, p. 30, citing Stengers & Despret, 2015), with the 'we' in this case referring to those on the upper contours of mathematics education. Following Swanson and le Roux (in press), I argue that this requires of us a disposition of *reflexivity*, a precondition of which is a practise of *recognising*, that is, listening for (dis)continuities, (im)mobilities and incompleteness of languages, literacies, and mathematics knowledges in the world. This thinking also requires of us a disposition of *reciprocity*. This involves *receiving humbly,* including learning other contexts, their languages, literacies, and knowledges. And given our authoritative positionings in the world, our thinking, our "mak[ing] things happen" (Kell, 2008, p. 892), must take on disposition of *giving responsibly*. For those of us on the upper contours, such work comes with a sense of vulnerability, discomfort, and precarity, on account of our newly visible incompleteness. Indeed, these are feelings long-experienced by the marginalised, on whom the burden to act is commonly laid.

Yet I am inspired by the argument that, for scholars thinking from relational, geopolitical South contexts located "at the receiving end of globalization", such as South Africa:

> …there is evidence of rich ecological resources in [these] communities, practices of navigating different scale levels, scope for voice and identity in translocal social spaces and traditions of renegotiating indexical orders for communication – despite the reality of dehumanising power. (Canagarajah, 2017, p. 53)

I am also inspired by the scholarship of mathematics education colleagues thinking from and for other relational geopolitical South contexts, my reading of which suggests energy in thinking about (im)mobile languages and literacies towards access and redesign in mathematics education (e.g. Lunney Borden et al., 2021; Ruef et al., 2020; Staats, 2018). This includes Sobral de Sousa's (2023), thinking from and with the practices of the Brazilian Northeastern peoples – specifically woodcuts and mamulengo theatre – presented in response to this article at the 12th International Conference of Mathematics Education and Society. I am inspired by the actions of the Mathematics Education and Society community at this Conference itself: (a) their moving between named languages (Portuguese, Spanish, English, and other languages represented at the Conference) and dialects thereof, accents, gestures, images, colours, textures, silences, music, poetry, digital and manual technologies, and voices of all ages towards meaning making and knowledge making, and (b) their listening for (im)mobilities, incompleteness, and so on, in this process.

Thus, with my intention of inviting conversations about concepts-in-use storied in other contexts, I end my contribution with brief 'stories' from my own research as described in this section and that of Kell (2006, 2008). These differ from the island narrative with which I commenced. I acknowledge that these are recontextualised narratives – of Kell's research lens on Nomathamsanqa and MamaSolani, and of my lens on a lecture and students in a mathematics class – of those "who are superficially nothing like ourselves" (Gqola, 2021, p. 44, following Mistry & Schuhmann, 2015). Yet they help us to "make sense of something outside of the story itself" (p. 45). In particular, I invite the reader to listen for: the range of language codes, modes, and seemingly "mundane" texts (Kell, 2008, p. 892) as well as knowledges that are central to the meaning trajectories. And therein, listen; for openings and closings, mobilities and permanencies, continuities and discontinuities, entanglements and separations, and incompleteness; for symbolic violence; for the agency of participants, their "mak[ing] things happen" (Kell, 2008, p. 892), including mediation focusing on participants' resources, not deficits.

6. Epilogue: Archipelagic thinking about (im)mobile language and literacies

6.1 (Im)mobile language and literacies in first-year university mathematics

This story is located in a first-year university mathematics workshop, in the course described in Section 5. In the previous class, the lecturer made explicit the use of the mathematical discourse practices of making connections, asking questions (including what may seem silly questions in a university mathematics class), and sitting with the discomfort of not fully 'knowing'. This workshop is named "Visualisation, play and being almost right". The mathematical topic, polynomial approximations of functions, which is not named explicitly in the workshop introductions, is not a school mathematics topic, and has not yet been studied in the first-year university lectures. The students are seated at tables, in randomly allocated groups of five to six students. Vertical, erasable boards (each with a variety of coloured pens, and a cleaning cloth) mark the perimeter of the classroom.

The lecturer asks the students to use "structured play" for first task, which is written in words on an audiovisual slide projected onto a board: students are to use a freely-available graphing software (or similar) to "find a parabola that approximates the sine curve". An example of the input language – involving words and symbols – required by this software is also given ("plot the graph of y=sinx, 0<x<pi"). Students get to work on the available electronic devices (there is a mix of laptop computers, tablets, and cellphones in each group), with some also writing and drawing in their notebooks. At times, the lecturer talks to the class: encouraging students to also talk to one another, and to link to their knowledge of the transformation of functions from school, and asking questions such as "What error is acceptable?" The students exclaim when they see an approximation that they think looks reasonable.

The lecturer presents the second task verbally and in a written worksheet. The first part of exploring what polynomials can be used to approximate the function $y = e^x$, is done by the groups on the vertical, erasable boards. The lecturer acknowledges the discomfort that may come with this change in language mode ("feeling lost without your devices, you will be back"). The lecturer encourages them verbally, "If you think you can't, you can! Just looks different", again linking to school mathematics. He also models what might be considered a silly question by proposing they start with the straight line $y = 1 + x$. A little later he encourages the use of an infinite series, writing the symbols "$1 + x + \frac{x^2}{2} + \ldots$" on the board.

Once students have drawn graphs manually on their boards, the lecturer instructs them to return to the tables, and using the steps in the worksheet (again, including possible input language for the software), to use the "technology to explore more efficiently, on your own". However, the lecturer identifies that students are having difficulty with the concept of "polynomial", and mediates by proposing a change in to talking with a peer: "What is a polynomial? What is this thing we are talking about?" However, very few students do this, with most focusing intensely on using the software on their individual devices. So, again, the lecturer shifts the language and literacy practices, this time to group writing on the boards: "Combine in your group, I want definitions of a polynomial, seven definitions, two minutes. Write your definitions on the board." Now, the students move quickly to the boards. As they write definitions (such as "The sum of x-terms each to the power of positive integers"), the lecturer asks questions verbally: "What about x to the minus 1? y is equal to x to the ½? What is a non-polynomial?" He emphasises the value of these languages and literacies for building connections, rather than "just" using an online search engine. Now, compared to when they were seated and working individually, there is lots of talk when students are asked to "talk about what you have learned so far" while still at the boards.

The final writing task on the boards is for student to sum up their mathematical process in a sentence: "What are we trying to do mathematically?" They write, for example: "Modelling $^{\wedge\text{non-polynomial}}$ functions using polynomial functions"; "We are approximating a function around a point using a polynomial." As he reads what groups have written, the lecturer questions the class, "But why do we want to do this?", but indicating they do not need to answer immediately. Rather, he sets students to work on the rest of the worksheet, "working individually, in groups, the boards, technology, whatever works for you". Students use a mix of the languages and literacies used thus far.

To end, the lecturer asks each student to reflect on the workshop, and write on paper ways in which the technology "helped" or "got in the way" of their learning. Finally, students watch a short videoclip, projected on the board, of a mathematician talking about approximating solutions as a mathematical practice.

6.2 (Im)mobile language and literacies in a housing building project

Kell's (2006, 2008) stories are located in a government-subsidised brick housing project on the Cape Flats in the early years of South Africa's democracy. The first-time homeowners, mostly women, would in this context be regarded, from a racial, socio-economic, spatial, linguistic, knowledge and educational perspective, as positioned on the lower contours of the Cape Peninsula.

On account of a disability, Nomathamsanqa was allocated a government house, rather than having to build her own. Yet the house is poorly built, concerns she repeatedly raised verbally at local housing association meetings. But her oral narrative did not have function in this context. Then, with the encouragement of Kell who had initiated a writing project in the community, Nomathamsanqa wrote her narrative in a child's exercise book, using her language of isiXhosa. Her reading of this written story did have function in the local housing association context, and moved beyond this; she was invited to repeat her reading from this book at a nearby meeting of the association, an act that was repeated at a provincial level, and finally at a national association meeting. In the last-mentioned forum, Nomathamsanqa's story materialised in the physical collection of money to rebuild her house. Kell (2006) notes that subsequent events would have involved written texts in the form of lists of names, calculations, and receipts for building materials. At each stage of the process, as certain languages and literacies moved across contexts, the process became more durable and irreversible, ultimately culminating in the physical rebuilding of the house.

What the movement of the aforementioned quantitative meanings might have looked like in the building project, is suggested by the story of MamaSolani's purchasing of materials to build her house. In Kell (2006), we start following the meaning-making trajectory with MamaSolani's visit to the house of the bookkeeper of the local housing association. Based on the records of prior expenditure, MamaSolani was issued with a R2,000 cheque to purchase building materials. As an isiXhosa speaker, she expressed concern about navigating the English and Afrikaans space of the building supply shop, and the bookkeeper advised her to ask for the assistance of a named shop assistant. Although MamaSolani had a sense of what to purchase, she first met with the builder at her building site. Here, the written cheque had function; glancing at the written amount, the builder listed, writing with his carpenter's pencil on a small scrap of paper provided by MamaSolani, the required number of bags of cement, doors etc. At the building shop, six kilometres away, the named shop assistant used this list to write her own in a notebook, all the while talking extensively with MamaSolani, in isiXhosa, about each item. This list and the cheque then had function at the checkout. Speaking in English, accompanied by isiXhosa translations by the shop assistant, the teller performed two calculations; by entering and adding each purchase on a computer, he showed MamaSolani how much money she had spent; by entering each amount and subtracting from R2,000 on a separate calculator, he showed what money was remaining. These calculations were realised in a printed invoice, and MamaSolani handed over the cheque on which she wrote her 'English' name, and was issued with a written receipt. Returning to the bookkeeper's house, MamaSolani pasted the receipt into her own record book, and the bookkeeper recorded the details in the expenditure record, alongside that of other members of the housing association. Again, as certain languages and literacies moved across contexts in the actions of MamaSolani and others, the process became more durable, and MamaSolani's physical building materials were delivered the next day.

Acknowledgments

I am grateful to participants at the 12th International Mathematics Education and Society Conference (MES12) for their active, critical engagement with my scholarship, and hence their contribution to taking the ideas forwards in this article. I gratefully acknowledge MES colleagues who have translated my

writing into Portuguese and Spanish, conversations about which continue to enrich my thinking. A acknowledge the MES12 Local Organising Committee for securing financial support to attend the Conference.

Author Biography

Kate le Roux is an Associate Professor at the University of Cape Town, South Africa. Her scholarship is located at the interplay of languages, literacies, mathematics and knowledge-making in science and engineering, Using notions of equity, access, justice, (re)design, relations, and place, she pursues questions of: What mathematics knowledges and ways of knowing may be relevant (for students, society, the Earth) at a contemporary university in a globally connect world? And using what education practices, languages, and literacies? She draws on critical thinking in mathematics education within the socio-political and socio-ecological, languages and literacies, and decolonial thinking. ORCID: 0000-0002-0221-8287

References

Achebe, C. (1974). *Arrow of God.* Heinemann.

Ahmed, S. (2007) The language of diversity. *Ethnic and Racial Studies*, *30*(2), 235-256. https://doi.org /10.1080/01419870601143927

Anonymous. (2018). Participant in *Room for manoeuvre: Translanguaging in South African education.* University of Cape Town. https://www.youtube.com/watch?v=Uu1h-llDvaA

Appadurai, A. (2000). Grassroots globalisation and the research imagination. *Public Culture*, *12,* 1-19. https://muse.jhu.edu/article/26176

Arndt, J. S. (2022). *Divided by the word*. Wits University Press

Ashcroft, B. (2014). Knowing time: Temporal epistemology and the African novel. In B. Cooper & R. Morrell (Eds.), *Africa-centred knowledges: Crossing fields and worlds* (pp. 64-77). James Curry.

Attwell, D. (2021, September 29). An Island by Karen Jennings: A book review. *LitNet.* https://www.litnet.co.za/an-island-by-karen-jennings-a-book-review/

Bakhtin, M.M. (1981). *The Dialogic Imagination: Four Essays* (M. Holquist, Ed. and Trans.). University of Texas Press.

Barwell, R. (2016). Mathematics education, language and superdiversity. In A. Halai & P. Clarkson (Eds.), *Teaching and learning mathematics in multilingual classrooms* (pp.25-39). Sense.

Bhan, G. (2019). Notes on a Southern urban practice. *Environment and Urbanization. 31*(2), 639-654. https://doi.org/10.1177%2F0956247818815792

Blackledge, A., et al. (2018). Language and superdiversity: An interdisciplinary perspective. In A. Creese & A. Blackledge (Eds.), *The Routledge handbook of language and superdiversity: An interdisciplinary perspective* (pp.xxi-xiv). Routledge.

Blommaert, J. (2010). *The sociolinguistics of globalization*. Cambridge University Press.

Blommaert, J. (2021). Sociolinguistic scales in retrospect. *Applied Linguistics Review*, *12*(3), 375-380. https://doi.org/10.1515/applirev-2019-0132

Canagarajah. S. (2017). Negotiating mobile codes and literacies at the contact zone: Another perspective on South African township schools. In C. Stroud & M. Prinsloo (Eds.), *Language, literacy and diversity: Moving words* (pp.34-54). Routledge.

Christie, P. (2005). Towards an ethics of engagement in education in global times. *Australian Journal of Education, 49*(3), 238–250. https://doi.org/10.1177/00049 4410504900302

Connell, R. (2007). *Southern theory*. Polity Press.

García, O., & Lin, A. M. (2018). English and multilingualism: A contested history. In P. Seargeant, A. Hewings, & S. Pihlaja (Eds.), *The Routledge handbook of English language studies* (pp.77-92). Routledge.

Glissant, É. (1997). *Poetics of relation* (B. Wing, Trans.). University of Michigan Press. (Original work published 1991).

Govender. P. (2023, January 2023). More matrics opt for 'easy' maths literacy. *TimesLIVE*. https://www.timeslive.co.za/sunday-times/news/2023-01-22-more-matrics-opt-for-easy-maths-literacy/

Gqola, P. D. (2021). *Female fear factory: Gender and patriarchy under racial capitalism*. Melinda Ferguson Books.

Green, L. (2020). *Rock/water/life: Ecology and humanities for a decolonial South Africa*. Wits University Press.

Greer, B., & Skovsmose, O. (2012). Introduction: Seeing the cage? The emergence of critical mathematics education. In O. Skovsmose & B. Greer (Eds.), *Opening the cage: Critique and politics of mathematics education* (pp.1–20). Sense.

Haraway, D. J. (2016). Staying with the trouble: Making kin in the Chthulucene. Duke University Press.

Hichens, J., & Jennings, K. (2021, February 19). An island by Karen Jennings: An interview. *Litnet.* https://www.litnet.co.za/an-island-by-joanne-hichens-an-interview/

Jennings, K. (2020). *An island*. Karavan Press.

Jennings. K., & Malec (2022, November 15). When the Booker longlisting happened, I thought, oh, I'm going to have to start writing again'– Karen Jennings chats to Jennifer Malec about writing, fame and loneliness. *The Johannesburg Review of Books*. https://johannesburgreviewofbooks.com/2022/11/15/when-the-booker-longlisting-happened-i-thought-oh-im-going-to-have-to-start-writing-again-karen-jennings-chats-to-jennifer-malec-about-writing-fame-and-loneliness-plus/

Kell, C. L. (2006). Moment by moment: Contexts and crossings in the study of literacy in social practice. Unpublished PhD thesis, The Open University.

Kell, C. (2008). 'Making things happen': Literacy and agency in housing struggles in South Africa. *The Journal of Development Studies*, *44*(6), 892-912. https://doi.org/10.1080/00220380802058263

Kell, C. (2015). Ariadne's thread: Literacy, scale and meaning making across space and time. In C. Stroud & M. Prinsloo (Eds.), *Language, literacy and diversity: moving words* (pp.72-91). Routledge.

Kell, C. (2017). Traveling texts, translocal/transnational literacies, and transcontextual analysis. In S. Canagarajah (Ed.), *The Routledge handbook of migration and* language (pp. 413-430). Routledge.

Khuzwayo, B. (2005). A history of mathematics education research in South Africa: The apartheid years. In R. Vithal, J. Adler, & C. Keitel, C. (Eds.), *Researching mathematics education in South Afric*a (pp.307-327). HSRC Press.

Le Roux, K., & Swanson, D. (2021). (Re)Imagining spatialities for equity in mathematics education. In D. Kollosche (Ed.), *Proceedings of the Eleventh International Mathematics Education and Society Conference* (Vol. 2, pp.603-612). Tredition. https://zenodo.org/record/5415154#.YVnqXZpBztQ.

Le Roux, K., Ngoepe, M., Shaw, C., & Collier-Reed, B. I. (2022). Language and disciplinary literacies for accessing, learning and communicating meaning: Students' experiences of the transition from school to first-year undergraduate engineering. *European Journal of Engineering Education*, *47*(6), https://doi.org/1144-1163.10.1080/03043797.2022.2122406

Lunney Borden, L., Throop-Robinson, E., Carter, E., & Prosper, S. (2021). Sets of, rows of, jumps of: Verbing multiplication. *For the Learning of Mathematics*, *41*(3), 2-8. https://www.jstor.org/stable/27091211

Makoni, S., & Pennycook, A. (2007). Disinvesting and reconstituting languages. In S. Makoni & A. Pennycook (Eds.), *Disinvesting and reconstituting languages* (pp.1-41). Multilingual Matters.

Mbembe, A. (2021). *Out of the dark night: Essays on decolonization*. Columbia University Press.

McKinney, C. (2017). *Language and power in post-colonial schooling: Ideologies in practice*. Routledge.

Mistry, J., & Schuhmann, A. (2005). Introduction: By way of context and content. In J. Mistry & A. Schuhmann (Eds.), *Gaze Regimes: Film and feminisms in Africa* (pp.ix-xxxiv). Wits University Press.

Morgan, C., Craig, T., Schuette, M., & Wagner, D. (2014). Language and communication in mathematics education: An overview of research in the field. *ZDM Mathematics Education*, *46*, 843–853. https://doi.org/ 10.1007/s11858-014-0624-9

Ndhlovu, F. (2016). A decolonial critique of diaspora identity theories and the notion of superdiversity. *Diaspora Studies*, *9*(1), 28-40.

Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Harvard University Press.

Nyamnjoh, F.B. (2020). *Decolonising the academy: A case for convivial scholarship***.** Carl Schlettwein Lecture 14, Basler Afrika Bibliographien. Basel, Switzerland.

Prinsloo, M., & Krause, L.S. (2019). Translanguaging, place and complexity. *Language and Education*, *33*(2), 159-173. https://doi.org/10.1080/09500782.2018.1516778

Ruef, J. L., Jacob, M. M., Walker, G. K., & Beavert, V. R. (2020). Why indigenous languages matter for mathematics education: A case study of Ichishkíin. *Educational Studies in Mathematics*, *104*, 313-332. https://doi.org/10.1007/s10649-020-09957-0

Shay, S., Collier-Reed, B., Hendry, J., Marquard, S., Kefale, K., Prince, R., Steyn, S., Mpofu-Mketwa, T.J., & Carstens, R. (2020). *From gatekeepers to gateways: Courses impeding graduation annual report 2019*. University of Cape Town.

Silverstein, M. (2014). How language communities intersect: Is 'superdiversity' an incremental or transformative condition? *Tilburg Papers in Culture Studies* (Paper 107), University of Tilburg.

Sobral de Sousa, E.C. (2023). Tradicoes nordestinas e matematica: potencialidades do teatro de mamulengos e xilogravura. In R. Marcone, P. Linardi, R. Milani, J.P. A. de Paulo; A. Moura Queiroz,

& M. T. da Silva (Eds.), *Proceedings of the 12th International Conference of Mathematics Education and Society* (pp. 103-111). MES.

Spaull, N. (2019). Equity: A price too high to pay? In N. Spaull & J. Jansen (Eds.), *South African schooling: The enigma of inequality* (pp.1-24). Springer.

Staats, S. (2018). Coloring conjectures with sound, silence, syntax and gesture: A multimodal poetic analysis. *For the Learning of Mathematics*, *38*(2), 2-8. https://www.jstor.org/stable/10.2307/26548489

Staats, S., & Laster, L. A. (2019). About time. *For the Learning of Mathematics*, *39*(1), 44-47. https://www.jstor.org/stable/10.2307/26742012

Stengers, I., & Despret, V. (2015). *Women who make a fuss: The unfaithful daughters of Virginia Woolf*. University of Minnesota Press.

Swanson, D., & le Roux, K. (in press). Exchanging conceptual gifts: Bringing into dialogue critical global citizenship education and sociopolitical mathematics education. In A. Chronaki, & A. Yolcu (Eds.), *Mathematics education and the boundaries of global citizenship. Routledge.*

Tutuola, A. (1952). *The palm-wine drinkard*. Faber and Faber.

Tutuola, A. (1954). *My life in the bush of ghosts.* Faber and Faber.

Vertovec, S. (2007). Super-diversity and its implications. *Ethnic and Racial Studies*, *30*(6), 1024-1054. https://doi.org/10.1080/01419870701599465